DOCUMENT RESUME

ED 473 181 CE 084 417

TITLE	GED as Project: Pathways to Passing the GED. Volume 2: Math.
INSTITUTION	James Madison Univ., Harrisonburg, VA. Workforce Improvement Network.
SPONS AGENCY	Virginia State Dept. of Education, Richmond. Office of Adult Education and Literacy.
PUB DATE	2002-08-30
NOTE	140p.; For Volume 1, see CE 084 416. For related materials, see: http://web.jmu.edu/gedproject/intro_page.htm.
AVAILABLE FROM	For full text: http://web.jmu.edu/gedproject/print_grid_2.htm.
PUB TYPE	Guides - Classroom - Learner (051) -- Guides - Classroom - Teacher (052)
EDRS PRICE	EDRS Price MF01/PC06 Plus Postage.
DESCRIPTORS	Adult Education; Algebra; Classroom Techniques; Cognitive Style; Data Analysis; Fractions; Geometry; Graphs; *High School Equivalency Programs; Inquiry; Instructional Materials; Learning Activities; Learning Processes; Learning Strategies; Mathematics Education; *Mathematics Instruction; Number Concepts; *Problem Solving; Program Development; Ratios (Mathematics); Secondary School Mathematics; Self Management; Student Evaluation; *Student Projects; Teacher Developed Materials; *Teaching Methods; Test Wiseness
IDENTIFIERS	*General Educational Development Tests; *Learner Centered Instruction

ABSTRACT

This guide presents math-focused learning projects and accompanying inquiry activities to help students pass the math portion of the GED 2002. It is Volume 2 of a proposed four-volume series; Volume 1 describing the concept of the GED as project is also available. Section 1 relates GED as project to the math portion of the GED and explains how inquiry activities use Official GED Math Practice Test questions as stimuli and can serve as models for teacher-designed activities. It introduces the template for math inquiry activities, a series of steps and questions that fulfill the learner-centered thinking and process this guide proposes. Section 2 is an introductory learning project that helps learners comprehend and internalize information about the GED, "GED Math and You." The two inquiry activities are based on the template described in Volume 1. The math template is the basis for the 1-6 inquiry activities found in the nine learning projects: Number Line and Informational Graphing; Rates; Algebra/Variables; Algebra/Using Equations; Data Analysis--Mean and Median; Fractions, Proportions, and Percents; The Coordinate Plane, Intercepts, and Slopes; Geometry--Area, Perimeter, and Volume; and Geometry--Angles and Triangles. Appendixes include a document that lists each Math Practice Test question in the left-hand column and enumerates the Accessible Math Content, Learning Skills, and Test-Taking Skills in three columns; and sample individual action plans. (YLB)

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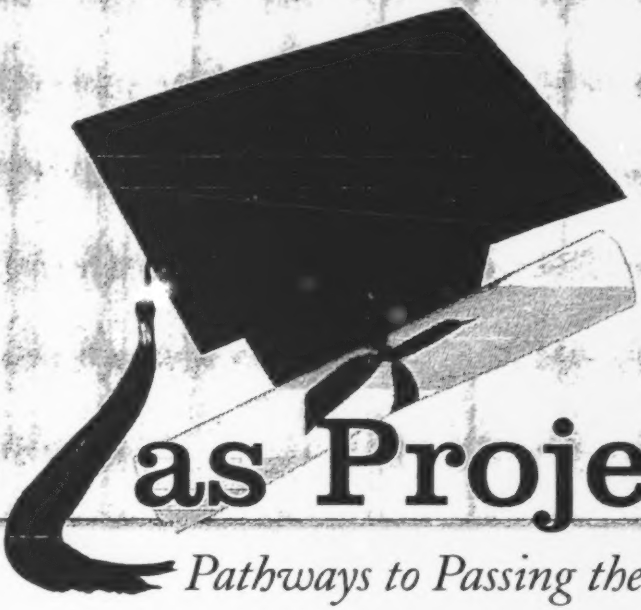

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Pathways to Passing the GED

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Volume ❷ MATH

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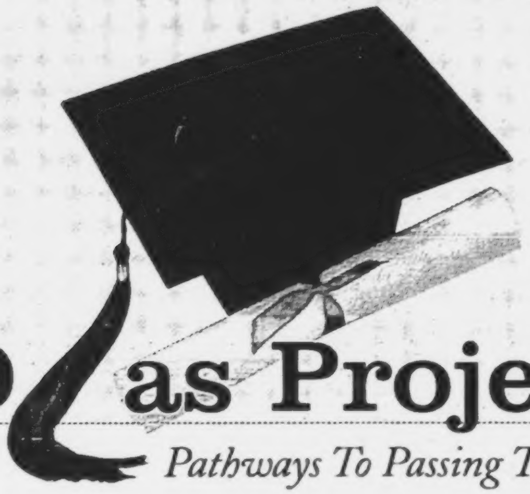

GED as Project

Pathways To Passing The GED

GED as Project

May 2002

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Funded by Virginia Department of Education

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Workforce
Improvement
Network

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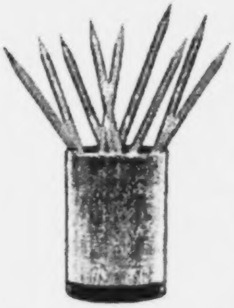
Preface



The GED high school equivalency exam has been available to adults for nearly 60 years. Yet, according to the 2000 Census, an estimated 700,000 adults in Virginia have not completed high school nor taken the GED. They are at a disadvantage in our fast-paced, information-driven age, where formal learning and schooling are more important than ever. Helping those adults achieve success on the GED remains, as it has been for many years, a central tenet of adult education in Virginia and across America. The implementation of GED 2002 presents a unique opportunity for adult educators to help adults achieve their goal of attaining a GED. Now seems an appropriate time to examine the current needs, practices and state of the art for preparing adults to pass the GED. We must take a fresh look not only at the subject matter, but also at the way it is taught.

We have examined the GED, its content, its structure, both old and new, and the skills embedded in the test. In addition, we have reviewed many current teaching methodologies. Our review has led us to propose *GED as Project: Pathways to Passing the GED* as a means of achieving effective results with adults pursuing their GED. As the name implies, the overarching principle of *GED as Project* is the value of project-based learning in adult education. We propose that the GED test itself can be a powerful project for those adults who choose to pursue it.

In Volume 1: Introduction, we describe our concept of the *GED as Project*, articulating the role of the instructor, the role of the individual, both as test taker and as learner, and the role of instructional materials in the classroom. We outline for instructors the necessary practices for using this approach. Central to *GED as Project* are the Inquiry Activities, designed to stimulate interest and discovery by the learner, facilitated by the instructor. Grouped together by theme and/or skills to be explored, Inquiry Activities form the basis of Learning Projects. We define Learning Project and Inquiry Activity, provide a template or guide to use in developing Inquiry Activities, and provide sample Inquiry Activities for two Learning Projects: "GED and You" and "GED and You Revisited." In addition, we provide an annotated list of references for use with GED 2002.

In Volume 2: Math, we use items from an Official GED Practice Test to develop the Inquiry Activities that, grouped together, form the Math Learning Projects. Also included in this volume is a Learning Project called "GED Math and You," which has been designed as a companion to "GED and You" in Volume 1.

Through the learning approach advocated by *GED as Project*, the adult who seeks help in achieving the GED is regarded in two distinct ways: as test-taker and learner. Using *GED as Project* allows instructors to facilitate the adult in the skill of taking tests, as well as in the skill of learning. One helps the adult student to pass a credentialing test; the other equips him or her both for life-long learning and competing in today's world — a win/win for all adults pursuing their GED.

Foreword

GED as Project: Pathways to Passing the GED has been developed through the hard work, dedication and vision of many adult education professionals. Funded by the Office of Adult Education and Literacy, Virginia Department of Education, The Project was conducted by Virginia's Workforce Improvement Network (WIN), a partnership between James Madison University and the Virginia Literacy Foundation.

The first phase of this project included the development of the problem-based approach as presented in Volume 1 of *GED as Project* and the Math Learning Projects found in Volume 2. The Language Arts – Reading and Writing Learning Projects will be published in mid-2003 with Science and Social Studies following in 2004. Go to the *GED as Project* web site at http://www.jmu.edu/gedproject to see the most current information about this project and to view video clips that illustrate how to use the *GED as Project* approach in the classroom. Information about ordering *GED as Project* videos on CD-ROM is also on the web site.

The project team members are as follows:

- Dr. Diane Foucar-Szocki – Research/Principal Investigator
- Barbara E. Gibson – Project Management
- Edmund Vitale, Jr. – Curriculum
- Susan Holt – Instruction
- Bonnie Burt – Technology
- Candace Miles – Program Assistant

We are deeply appreciative of the consultants who guided and supported this phase of our work. Their commitment to the vision of *GED as Project* from the very beginning inspired the team to higher levels of performance than we imagined possible. Special words of thanks must go to Myrna Manly without whose knowledge, experience and patience the Math section of *GED as Project* would not have been possible. Consultants for this project were:

- Myrna Manly – Consultant, author and former math instructor
- Dr. Thomas Valentine – Author and Professor in Adult Education and Research, University of Georgia
- Dr. Kenn Barron — Assistant Professor of Psychology, James Madison University

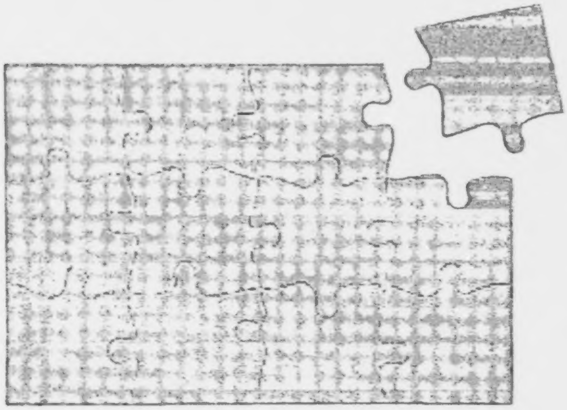
Field testing of *GED as Project* was conducted with three adult education programs across Virginia. The instructors and administrators who participated in the field test not only used the materials we provided, but also made suggestions for additional materials and approaches. They provided important insights and ideas to the project team. The adult learners who agreed to participate in the field test also contributed significantly to *GED as Project* by allowing us to collect samples of their work, sharing their thoughts and ideas while in the classroom and giving valuable input during site visits. The field test sites and participating adult educators are listed below:

- New River Community College, Adult Education — Jenny Leadbetter-Bolte, Coordinator and Instructors: Sara Smith, Charlotte Leslie, Rebecca Yearout
- Prince William County Public Schools, Adult Education — Susan Garlock, Coordinator and Instructors: Eileen Rakshys, Vickey Logan, Debbie Caselli
- Regional Adult Education, Planning District 9 — Phyllis Metzger, Coordinator and Instructors: Margaret Buraker, Clysta Walters, Eileen Moser

The following deserve special recognition for their contributions to specific aspects of the project:

- Robert MacGillivray, Adult Secondary/GED Administrator, Office of Adult Education and Literacy, Virginia Department of Education, who gave guidance and support to the project team throughout the development process
- Gwen Smith, Specialist for Literacy Projects, Office of Adult Education and Literacy, Virginia Department of Education, who helped to write the scripts for the videotapes accompanying *GED as Project* and starred as Mrs. Harriman, the instructor
- Marcia Phillips, independent consultant and WIN Certified Program Developer, who edited *GED as Project* and wrote the pages for the project's web site
- Lydia Powers, graphic designer, Madison Media Labs, a program of James Madison University, who created the logo for the print and web versions of *GED as Project*
- John Hodges, Production Manager, James Madison University, School of Media Arts and Design, who served as videographer for the project

Finally, we wish to recognize Dr. Yvonne Thayer, Director of the Office of Adult Education and Literacy, Virginia Department of Education, for her commitment to the advancement of adult education practice and her dedication to the adults for whom the GED is a pathway to success as workers, parents and citizens. Her desire for an articulated approach to teaching the new GED ultimately led to the development of *GED as Project*. We thank her for her leadership and her vision.



Section 1

Math And The GED 2002

Introduction

As the instructor in *GED as Project*, you will be using the math-focused Learning Projects and accompanying Inquiry Activities presented in this guide, along with ones you develop to help your students pass the math portion of the GED 2002. The Inquiry Activities presented here use Official GED Math Practice Test questions as stimuli and can serve as models for the ones you will design. All Inquiry Activities employ discovery and group learning, encouraging the development of analytical, creative, and practical thinking as well as test-taking skills for the GED 2002. By developing GED math instruction in this way, you will begin to incorporate and develop thinking and problem-solving skills along with content knowledge.

The Learning Projects and Inquiry Activities used throughout this guide employ an integrated approach to learning. Because GED 2002 math requires reading comprehension, thinking, reasoning, estimation, and, finally, computation skills, we incorporate these reading, writing and thinking skills into our instruction. By asking learners to think differently and at a higher level, *GED as Project* becomes an excellent vehicle for transforming math instruction. As a result, your responsibilities adjust and change from heavy reliance on direct instruction to a greater balance between guidance and instruction. In this approach, learners will struggle with understanding math, reading and reasoning within the Learning Projects they and other classmates undertake. From this effort comes deeper learning and greater understanding for the learner.

Through the questioning in the Inquiry Activities by the instructor and with each other, learners will discover the need for reading within the context of math. They will discover that reading is contextual, that they must learn to read math word problems in order to be successful. As the instructor, you will guide learners to process information, facilitating them to think about math, not just to recall facts. You may develop Learning Projects and corresponding Inquiry Activities yourself and ask questions so that learners come to understand the math concept connections among different kinds of problems. Ultimately, you will lead the learners toward developing and solving their own Inquiry Activities for the Learning Projects they have identified. You will guide the learners to the underlying concepts, connections, thinking and reasoning of the GED test questions, not merely the computational skills necessary.

Introduction to Math Learning Projects

An important component of *GED as Project* is that the problems on the Official GED Practice Test are used as stimuli in the Inquiry Activities for rich instruction that engages students in reading comprehension, reasoning, and analytical, creative and practical thinking. The sequence in which the GED practice test items are examined should provide a coherent course of study that builds on similar ideas to construct more complex, abstract concepts. The groupings of GED Practice Test items that build on similar ideas are collected together in Learning Projects. The test questions grouped into a Learning Project and sequenced into Inquiry Activities build upon each other in an effort to make clear the math concept serving as the foundation of the Learning Project.

The sequence of GED practice test items in Learning Projects — from simple to more complex — connects, integrates and advances previously learned math concepts. You will find that you are not using the traditional adding, subtracting, whole numbers, fraction and decimal skill sequence of traditional math instruction. In the active learning process, the learner is asked to recognize the underlying tapestry of coherence when he/she connects, integrates and advances previously learned math concepts designed into the Learning Projects. Even learners with higher computational skill levels can benefit from the Learning Projects and Inquiry Activities, focused as many of them can be on math reading and reasoning.

Using an Official GED Math Practice Test, this guide has provided an example of test questions collected into Learning Projects that build reasoning power. (We are using the Practice Test PA from the 2002 GED test.) Ultimately, you may want to group, as well as sequence, the test items into your own Learning Projects and accompanying Inquiry Activities to ensure that learners in your classroom will be exposed to the fundamentals of math, progressing from easy items to the more difficult ones.

To help you with collecting and sequencing test items into Learning Projects and Inquiry Activities, we have provided "What Math/Test-taking Skills Can You Access?" (Appendix 1.) This document lists each Math Practice Test question in the left-hand column, and enumerates the Accessible Math Content, Learning Skills and Test-taking Skills in three columns. This allows the instructor to gather together test questions that have similar accessible math content, learning skills, or test-taking skills.

Once similar test items are grouped into a Learning Project, then the test items in that Learning Project are sequenced into Inquiry Activities. The instructor can sequence the test items to expose progressively the math concept and/or learning skills that are the subject of the Learning Project. The sequence of Inquiry Activities within the Learning Project can be done in any way the instructor wishes, depending on the class members, the math the instructor wishes to emphasize, or any math goal the instructor and the class want to pursue.

Introduction to Math Inquiry Activities

As a final element of the process of Learning Project and Inquiry Activity development, a template for the Math Inquiry Activities is also included. The Inquiry Activity Template is presented as a series of steps and questions that fulfill the learner-centered thinking and process proposed by this guide.

The template (Figure A) has five major headings. The first three headings (Identify the Problem, Become Familiar with the Problem and Planning, Assigning and Performing) are important to the student, both as a learner and as a math test-taker. The approach to a test item outlined in these steps provides the test-taker with a standard procedure that can ease the tension of a test-taking situation. The final two items in the template – Sharing and Reflecting, Extending and Evaluating – are for the student as a math learner, focusing on the construction of meaning beyond the specific item itself. This emphasis is in keeping with the goal of this guide – that is, to build on the motivation of the student who wants to pass the GED but also to present a more complete picture of GED mathematics.

A more detailed discussion of this template follows.

Figure A

Template for Math Inquiry Activities – for the Test-Taker and Learner

1. **Identifying the Problem**
2. **Becoming Familiar with the Problem**
3. **Planning, Assigning and Performing Tasks**
    - ***Doing the Work***
    - ***Express the Problem in Other Terms****
    - ***Estimate Before Computing****

   Reaching a Conclusion
    - ***Come up with an Answer***
    - ***Compare Answer to Estimate****
4. **Sharing with Others**
5. **Reflecting, Extending and Evaluating**
    - ***Think about what you learned***
    - ***Extend what you learned to new situations***
    - ***Assess what you learned and how you learned it***

** Optional, depending on test item*

Introduction to Math Inquiry Process Template

The Math Inquiry Template provides a guide for thinking through the Inquiry Activities within the Learning Projects. You will note that the template designed for mathematics inquiry and extension activities is a modification of the overall template that is described for use in "The GED and You" Learning Project in Volume 1. Specific additional steps that apply to mathematical topics have been inserted, suggesting explicit methods that can develop math comprehension skills through analytic, creative and practical thinking. The num-

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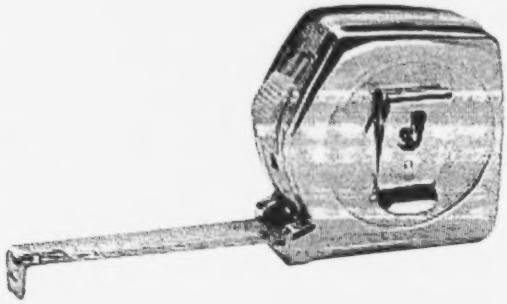


bered steps in the template (Figure A) are intended for all Inquiry Activities. The bulleted subsections of step 3 (Planning, Assigning and Performing Tasks) are designed to develop test-taking skills for the participant. Test items that do not involve computation will not require the steps that involve estimation.

Use creativity as you group the math concepts in test questions into Learning Projects and as you design the Inquiry Activities within those Learning Projects. Focus on the learners' progress toward their goals to pass the GED and allow their unique learning profiles to introduce variety into your design. The grouping of test items into Learning Projects, the focus of the Learning Project, and the sequencing of test items into Inquiry Activities can all vary depending on the makeup of the class. The actual classroom proceedings are likely to vary even more than you intend as each different group brings a different attitude each day.

Be flexible enough to make on-the-spot decisions as to the most appropriate way to modify the Inquiry Activities so that they meet the apparent needs of the group that day. Your modification may include:

- Extending the GED test question stimulus by adding new parts or changing some of the facts or numbers that would engage learners in further exploring the mathematical concepts imbedded in the original stimulus;
- Changing the stimulus questions (asking "what if?") by adding different variables within the same Inquiry Activity to allow more complete understanding of a particular concept;
- Making connections between math concepts within Learning Projects required by one Inquiry Activity to those required by others. Learners should be prompted to uncover the connections themselves, but may need help, perhaps from a Burst Lecture or a concept map, when they are unfamiliar with this kind of thinking.

Math Inquiry Process Template

A detailed discussion of the Math Inquiry Activity Template follows.

1. Identifying the Problem

Step 1 of the template is an important first step in the test taking sequence. At this stage of the process, learners should read the item carefully, decide just what the question is asking and then determine what kind of response is required: e.g., miles, hours, rate, number of items, cost, etc. The participants should not, at this point, go beyond getting an understanding of the words used in the problem and the kind of response required. This narrow focus for Step 1 is recommended because the template is setting up a process for the test-taker that can be used under the conditions of the actual test.

Some suggestions may encourage the participants at this step (and keep them within the test-taking process suggested).

- *Read the question carefully, as you would if taking the actual test.*
- *Here are some problem clarification questions you may want to consider when reading test questions:*
  What words and/or symbols might be important to understand in order to answer this problem and what are they telling you?
  What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

In Step 2 of the test taking sequence, the learner is engaged in the situation, or context, of the problem. To simulate test-taking conditions, this should be an individual activity. The step is introduced by the following to keep the learner focused on the test-taking process:

> *Ask yourself questions (like the ones on page 4 for example) about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.*

Here are some familiarization techniques that you as the facilitator could choose to use. The demands of the test item itself will determine which of them is appropriate. Develop others keeping in mind that what you ask the learner to do here should be able to be done under test conditions.

- Reread the question. What is it asking you to do?
- What do you already know about this kind of problem or about the math required?
- Focus on the action that is described in the item. Is it separating things or bringing things together? Is it asking for a comparison? Does it compare in a simple way, e.g. more than or less than, or does it ask how many times greater or less? This kind of thinking can be used as a step to discussing, later, which operation will carry out the action.
- How does reading comprehension help you to familiarize yourself with the problem? Can you restate the question in an easier way?
- How is reading a part of this problem? What do you have to do to be able to read the problem in order to become familiar with it? Are there any words or phrases that you don't understand? (Non-native speakers often do not catch the meaning of some Americanisms.)

Choose the familiarization technique most appropriate to the situation and the level of the learners. The idea here is to get the learners to ask these kinds of questions constantly so that when they are taking the test, they have a process to fall back on. Concentrate on the problem itself. There will be an opportunity to go beyond the specific problem in the later steps of the Inquiry Activity.

3. Planning, Assigning, and Performing Tasks

Planning

This is the step in the test-taking process where we ask the learners to come up with an answer. To simulate test-taking conditions, we suggest the following to the learner:

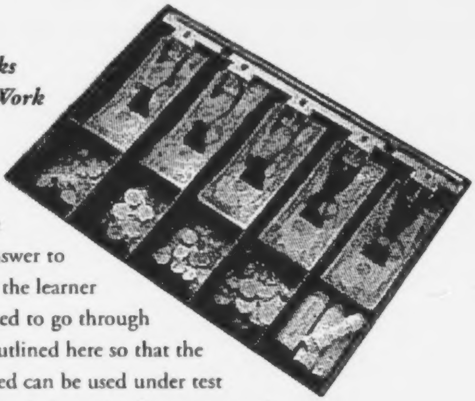
Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following directions and questions can be helpful.

Assigning

This would generally be an individual activity so there would be no assigning of tasks.

Performing Tasks

Doing the Work



In this stage, the test-taker's aim would be to find the answer to the item, but the learner should be asked to go through the steps as outlined here so that the skills developed can be used under test conditions. A whole series of questions and directions can be used at this point, depending on the problem. One such direction would be:

- ***Express the Problem in other Terms***

One way the learners can start thinking about math is to ask them to mathematize the situation. This can be accomplished by writing a mathematical version of the situation and the action described using symbols, numbers, operation signs or relationship signs. Some GED items, known as set-up items, give answer choices that are in the format of mathematical equations or expressions. If this is the case, the test-taker is finished at this point. Otherwise, the test-taker would follow the next steps in determining how best to find the answer. In either case, the learner is just getting started because in Step 5 you will use the opportunity to tease all the math out of the item.

- ***Estimate the Answer before Comuting***

Estimating is one of the most crucial steps in the math process for both test-taker and learner. Many cognitive and context skills are involved.

An examination of the GED Math test shows that many of the multiple choice questions can be answered with good estimation skills alone. A test-taker can estimate an answer, review the answers in the test questions and discard the ones that obviously do not come close to the estimation. He/she does not always have to complete the calculation, just know how to estimate well. Learners, on the other hand, should not stop at the estimating phase of the Inquiry Activity. A goal is to have the learner get a good estimation and become aware what he/she was thinking and doing when estimating.

Here are some of the ways a learner can become aware of the process of estimation:

- Make an estimate.
- Note the steps used to arrive at the estimation. The learner should articulate as much of that process as possible. Creative and practical methods will surface at this point, reflecting a variety of ways to think about numbers, each potentially valid in its own right, with which the individuals feel most comfortable.
- The learner can answer the question: How does reading and understanding the problem and knowing the terms used in the problem help in the estimation process?

Reaching a Conclusion

The next two exercises continue the process for the test-taker.

- **Come Up with an Answer**

  At this point the learner must come up with an answer to the question.

- **Compare Your Answer to the Estimate**

Comparing answers to estimates is an activity that reinforces the estimation step but also includes thinking and math comprehension skills.

This step can lead to discussions on how to estimate, how estimation can be used to answer multiple choice questions and what thinking skills are needed to do good estimation. When you think these kinds of questions are appropriate, you can ask the learners to answer them in Step 4, Sharing With Others.

Some other points that can be addressed at this stage are listed below.

- Insist that the answer is only part of the learning process. The learners should be able to explain to others all of the thinking and the computational work that went into the problem solution.
- Determine the best method to do the problem in light of taking the GED test.
- Have the learners write out answers to problems in sentence form for some Inquiry Activities. This helps with the math thinking process, gets the learner back into the words of problem and reinforces the reading and estimation phases of the process.

4. Sharing with Others

This is an activity that every GED content area will have. Communicating their understanding reinforces the learners' making meaning of the problem they have completed. Having groups share their activities puts them in the role of teaching others. One learns best when one teaches.

The groups discuss and then report to the class the ways they solved the problem, how their estimates compared to the answers they got, examples of how the problem may appear in daily life and any other questions covered during Steps 1 through 3. The groups should be encouraged to lead class discussions, further helping to build communication skills.

5. Reflecting, Extending, and Evaluating

Step 5 in the template is devoted to the learner whose aim is broader than the test-taker. The learner is encouraged to learn about the mathematics represented by the item. An important reason for not stopping at the test-taker process through Step 3 is that the problems on the GED might be significantly different from the Practice Test problem. The learner has to explore other ramifications of the problem to be able to handle such items on the GED test. Step 5 gives the learners that chance.

Reflecting: Think about what you learned.

Each reflecting step is introduced with the following comment to reinforce this very important thinking skill:

> *Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.*

Reflecting questions tend to be analytical in Sternberg's *Successful Intelligence* model (Robert Sternberg, *Teaching for Successful Intelligence*, 2000). There are numerous issues you can ask the participants to reflect on. They can reflect on:

- Thinking skills learned
- Reading comprehension strategies used
- Math concepts mastered
- Math concepts to be mastered
- Test-taking skills developed.

Other reflecting questions that could also be asked follow.

- What did I need to know to be successful in getting this answer?

- Is there a different way to learn about the concepts presented here?
- How will this Inquiry Activity help me pass the math portion of the GED?

Extending: Extend what you learned to new situations.

Each extending step is introduced with the following comment to reinforce this very important learning skill:

> *In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe to make new connections to other information.*

The learner now gets a chance to build on the knowledge gained by making connections. Understanding relationships, observing patterns and recognizing differences are all important in getting a deep understanding of math concepts. These skills also help learners to think like a mathematician, a kind of thinking that may be more valuable to a GED test-taker than computational dexterity.

All of these extending activities can be done in groups and reported to the rest of the class. These questions tend to be creative and practical in Sternberg's *Successful Intelligence* model (2000.)

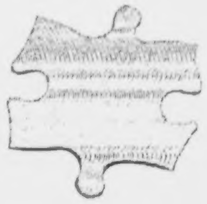
• Connections to Math Learned in Other Inquiry Activities Within Learning Project

Performing this step allows learners not only to understand math as a series of related concepts, but it also develops the fuller context of math, a context in which the imbedded reading and thinking skills are more apparent.

The connection to other math learned is divided into two parts. Part 1 is the connection to the math in the other Inquiry Activities that make up the Learning Project. As previously stated, the Learning Projects are chosen by instructors to contain Inquiry Activities focusing on a math concept in different math contexts and levels of difficulty, so that there should be a connection among all the Inquiry Activities within the same Learning Project. This connection is to be explicitly made here.

There are many techniques that can be used to encourage the connection to other math learned in related Inquiry Activities within a Learning Project. You can ask direct questions about how the math learned is the same and/or different in each of the Inquiry Activities. Another approach that can be effective is asking them to use their creative abilities by acting out the connections.

• Connections to Math Learned in other Learning Projects



The second part of making connections involves understanding relationships between Learning Projects, where there may or may not be an intended connection. This can also be an exercise where the creative abilities of the learners are encouraged. The Learning Projects may relate to one another only when looking at the big picture, so finding connections and articulating differences helps reinforce the understanding of the concepts involved.

You can use the same techniques to make connections between Inquiry Activities. It would be helpful to have a concept map to show connections among the Learning Projects and or Inquiry Activities used in the Math Section of *GED as Project.*

• Discover Different Ways to Solve the Problem

Here the learners can really get a chance to tap into their analytical, creative and practical intelligence. First, to get to an answer, they might have used a traditional procedure and/or computation skills. But now, getting a second way to come up with an answer encourages them to go outside the correct, or most mathematically efficient, or the by-the-book approach to doing a problem.

The context, the learner's experience and the learner's creative and practical intelligence come into full play. We are not asking them to think in a confining or rote way about math. We are, in fact, encouraging them to think outside the academic math box.

This can be done in groups. Each member of the group should be prepared to explain to the other members the different ways that he/she used to answer the question. The group can report all the various problem-solving methods to the whole class.

Here are some thoughts on activities that can be used at this point:

- Initially, the instructor's role is not to direct learners to the right answer or the right method, but to let them be as expansive in their thinking as possible. The instructor then uses the learners' ideas as a Just-in-Time assessment, and finally, guides the group or the class to the math method that is most efficient and effective in order to answer the stimulus question in the GED's timed-test environment, being careful to note that other methods may be better in other situations.

- One possibility that should be explored regularly is how the calculator could have been helpful in understanding and/or solving the specific problem.
- At this point the facilitator can introduce similar problems so that the learners have a chance to transfer and practice their skills.
- The group can agree on the most efficient mathematical way to do the problem, find in the texts explanations of how to do the problem and have the class discuss their research. Then they could research the other ways to do the problem.
- The class may also start keeping a list of terms or situations in problems that require certain math operations to be performed. This list may be maintained in poster form in the classroom and/or kept individually by students.
- The learners should discuss the similarities among the methods, what new approaches anyone learned, or the text support for the computation. During this time the facilitator does a Just-in-Time assessment and can make extensions or adjustments to the item, connections that could be made with other problems, and whether homework on computation would be in order for some or all of the learners. You will notice that the work of the groups does not stop at the right answer.
- The learners could revisit the stimulus and change some of the numbers or situation facts and determine how that changes the answers or the estimation process.
- Groups of learners can develop questions that are similar to the stimulus question and have other groups solve the problems.

- **Match the Problem to Your Experience – Find Examples in Daily Life**

Again, this is chance for learners to engage their creative and practical intelligence and a way for them to make concrete some abstract math concepts. This is not a step that helps learners with the GED itself, but it does develop their broader understanding of math as a tool to think about and solve everyday problems. Developing that understanding goes a long way to understanding the concepts that underlie math.

The more examples that the learners can match to daily living, the more aware each learner becomes about math. There are wonderful opportunities for the learners to share their examples and the math connections they made to those examples.

Evaluating: Assess what you learned and how you learned it.

Each evaluating step is introduced with the following comment to reinforce this highest thinking level in Bloom's Cognitive Taxonomy:

> *In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.*

The evaluation process is similar to the reflection process, but it tends to be more personal to each learner. Here are some evaluation questions that could be asked. These questions tend to be analytical in Sternberg's *Successful Intelligence* model (2000).

- What strengths of mine were apparent during the Inquiry Activity?
- What weaknesses were exposed, and what can I do to correct or compensate for them?
- How can I correct a perceived weakness?
    - Do I need to commit to attending class more regularly, schedule more time to complete homework and/or complete my homework?

As you can see, the Inquiry Activity template is dynamic and can be applied to different situations in multiple ways.

Student versions of all of the Inquiry Activities that follow may be downloaded from the *GED as Project* web site: http://www.jmu.edu/gedproject.

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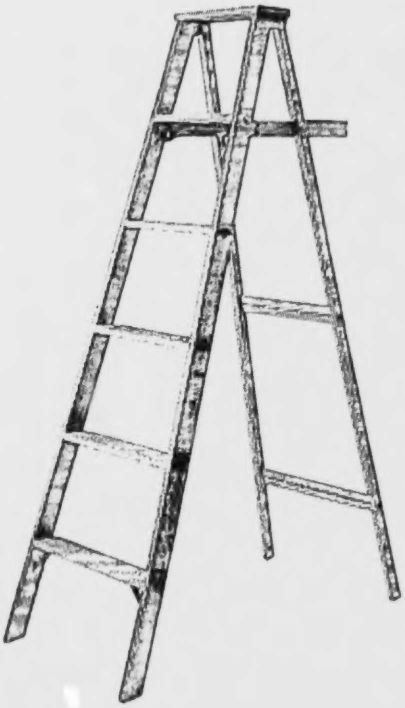
Section 2

Learning Project: GED Math And You



Introduction

GED as Project has introductory Learning Projects that help learners comprehend and internalize information about the GED, specifically "The GED and You" Learning Project in Volume 1 and now the "GED Math and You".

Before forming groups to explore the "GED Math and You" Learning Project, all members of the class should take the Math portion of the Official GED Math Practice Test (Form PA), under timed conditions, and without any learner interaction. Then the instructor should discuss each learner's score with him/her individually. The test score forms the basis for comparison of other forms of the GED Practice Tests taken later. Having been given as the initial Practice Test for assessment purposes, Form PA will now be used as the stimulus for the Inquiry Activities. The following Inquiry Activity is based on the template used in the "GED and You" and not on the Math Template just discussed. Once we get to math Learning Projects, we will use the Math Template.

GED Math And You Inquiry Activity #1:

Explore Your Experiences with Math

(Note: The italicized portions should be directed to students)

1. Identifying the Problem

This activity is started after the class has taken the GED Math Practice Test. This portion of the activity is done individually.

The problem you will be exploring involves the following question:

What are some of the things you know about math, and what are some of the things you want to know?

As in other Inquiry Activities, this first step asks that you not answer the question at once, but make sure you understand the questions being asked. If you want to discuss your understanding of the question with others, please do so.

2. Becoming Familiar with the Problem

This second step starts the process of thinking about what you already know about the subject. Take some notes on what you know about this question. To help you, consider the follow questions:

1. Think about the experience you have just had in taking the GED Math Practice Test. Don't think about whether you got an answer right or wrong but focus on what kind of math was on the test and how you reacted to it. Make some notes on your recollections.

3. *Think back beyond the Math Practice Test you just took and recall the exercise you had in the "GED and You" Inquiry Activity when you just looked at the questions on the Math Practice Test.*

- *What were your thoughts and reactions during that examination?*
- *What math seemed familiar to you, and what kind of math was unfamiliar?*
- *Think back to your school experience.*
- *What math courses did you take?*
- *What do you remember about the courses?*

3. Planning, Assigning and Performing Tasks

Planning

This is an individual activity. You can think about how you will organize your thoughts and recollections to answer this question.

Assigning

Not applicable.

Performing Tasks

Doing the Work

Think a little more about the experiences you had in math in this GED class and at school. Write down the thoughts that go through your mind as you remember those experiences. Write down notes to the following questions:

How do you feel when you think about math?

What are some of the things you know about math, and what are some of the things you want to know?

List below:

Make a list of your answers divided into the following categories:

What I know about math.

What I want to know about math.

Reaching a Conclusion

Now form groups. Each group will do the following:

1. From the lists that were developed individually by the group members, the group is to develop a list of math subjects that the group knows about.

2. Develop a list of the math subjects the group members don't know that much about.

3. Besides computational skills, what other aspects of math do you have questions about? List as many as possible.

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4. Discuss some of the emotional feelings you had when you thought about math in school.

The group should prepare its lists for presentation to the class and decide if it wants to discuss the emotional reactions the group members had to math at school.

4. Sharing with Others

Each group will present its lists to the rest of the class and be prepared to lead a class discussion if questions or comments are forthcoming.

The instructor will lead a discussion after the groups have made their presentations that references and pulls together some of the following items among all the groups:

- Class members' computational strengths in math;
- Class members' lists of other aspects of math that they are good at or would like to know more about;
- Lead a discussion on math anxiety if the learners bring the subject up. If there is a lot of discussion from the learners about math anxiety, then you might want to develop an Inquiry Activity that allows the learners to explore some of the written materials about math anxiety and share their research and observations with the rest of the class.

5. Reflecting, Extending and Evaluating

In this section, the questions are divided so learners can think about what they experienced, extend their learning experience to new and different contexts, and evaluate their learning. The kinds of questions used to accomplish this kind of thinking are the analytic, creative and practical questions discussed by Robert Sternberg, in his book, *Successful Intelligence.*

In general, creative and practical type questions are most useful in the Extending subsection. Analytical questions are most useful in the Reflecting and Evaluating subsections. Use your own questions in these areas that may come from your Just-in-Time assessment or comments made during the sharing portion of the Activity.

If you feel that the learners are sufficiently confident enough, they may lead this discussion. You as instructor are a member of the class and should participate in the discussion. This is a wonderful opportunity for Just-In-Time assessments.

Reflecting: Think about what you learned.

These questions tend to be analytical in Sternberg's *Successful Intelligence* model.

- *What new discoveries have you made about GED math?*
- *What impact do you think your emotional reactions to math have when learning the subject?*
- *What impact do you think your emotional reactions to math have when taking a math test?*

Extending: Extend what you learned to new situations.

These questions tend to be creative and practical in Sternberg's *Successful Intelligence* model.

- *Think about how you feel in a course that you like.*
- *How do you feel in that course and how can you transfer that feeling to a course you may not like, like math?*

Evaluating: Assess what you learned and how you learned it.

These questions tend to be analytical in Sternberg's *Successful Intelligence* model.

- *If you have a negative reaction to math, what do you think it is that creates that reaction?*
- *How do you think you could overcome that reaction?*
- *How did this process work for you?*
- *What made it valuable for you?*
- *How might you improve this activity?*

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GED Math And You Inquiry Activity #2:

Developing Your Math Action Plan

1. **Identifying the Problem**

   Your task in this Inquiry Activity is to look at the section of the Action Plan in Appendix 3 that deals with math called "My Math Action Plan." The questions asked in the Math Section of the Action Plan are:

   a) With which math subjects am I most familiar?
   b) What do I want to know about math?
   c) How can I use my reading skills to help with math word problems?
   d) How can I use my thinking skills to help with math word problems?
   e) How can I use my test-taking skills in the math portion of the GED?
   f) What parts of the "GED and You" Action Plan can I use in this Math Action Plan?

   Again, don't start doing the work; start to think about your understanding of the questions. Ask others if you need clarification.

2. **Becoming Familiar with the Problem (Individually)**
   - *Review the work you did in Inquiry Activity #1 of this Learning Project.*
   - *Review the Action Plan you developed.*
   - *Review the questions in the math portion of the Action Plan listed above. Make some preliminary notes about what you already know about the subject.*

3. **Planning, Assigning and Performing Tasks**

   Planning

   This is an individual activity. Plan how you are going to approach the task of answering the questions.

   Assigning

   To be done individually.

   Performing Tasks

   Doing the Work

   Start to think in a systematic way to develop an Action Plan for GED Math.

   Reaching a Conclusion

   Develop your Math Action Plan

4. **Sharing with Others**

   This activity is designed to help build awareness of the math portion of the GED, the math content and how the learner interacts with them. Becoming aware of these issues is an important part of the learning process.

   Discussing them is important too. Everyone should at least share his or her Math Action Plan with the instructor. The Plan should indicate that the learner's understanding has deepened, each in different ways. Someone else's insight might help another learner's understanding, whether it is the instructor's or classmates'.

   Decide if you would like to share your work with a partner, a group, or the class. You will be asked to share your revised plan with your instructor.

5. **Reflecting, Extending and Evaluating**

   Reflecting: Think about what you learned.

   These questions tend to be analytical in Sternberg's *Successful Intelligence* model.
   - *What new discoveries have you made about the GED, thinking skills or math?*
   - *What questions do you have now about the GED, thinking skills or math?*

   Extending: Extend what you learned to new situations.

   These questions tend to be creative or practical in Sternberg's *Successful Intelligence* model.
   - *Develop a new set of questions for the Math Action Plan.*
   - *Who at work or in your neighborhood might be able to help you study math?*

   Evaluating: Assess what you learned and how you learned it.

   These questions tend to be analytical in Sternberg's *Successful Intelligence* model.
   - *How do you feel about your motivation to pass the math portion of the GED?*
   - *Has your motivation to pass the GED increased?*
   - *How are you going to study for math?*
   - *Are you reading any more outside of class and if so, how might that have helped you in math?*

Learning Project

The Number Line And Informational Graphing

Introduction

This Learning Project is a great one to introduce your students to the GED Math test in general and to the procedures that are recommended for the Math Inquiry Activities. Mathematically, they focus on reading and interpreting informational graphs, some of which have sophisticated subjects, but do not require complex tasks. The activities come from items #1, #20, #21, and #15 (in that order) from the Official Practice Test, Form PA.

All the graphs are rectangular with two perpendicular axes, a familiar type to most students. Most students will not find a calculator to be helpful in finding answers to any of the items, but some like to have it at hand anyway. The activities are arranged so that they begin with the simple ideas and build on them to advance to the more complex.

The mathematical tasks begin with reading values from a graph, directly in Inquiry 1-1, and then using interpolation in 1-3 and 1-4. They also include interpreting what the graph is telling them, including the significance of some special points, the intercept in 1-2 and the intersection of two lines in 1-3. In the Reflection and Extension steps, the students are made aware that the steepness of the line is telling them about how fast a quantity is changing. That idea is treated more specifically in later Learning Projects.

In addition to the mathematics, this Learning Project also emphasizes some test-taking strategies that are important to your students. It stresses the importance of careful reading of the graphs as well as the questions to grasp the details. For multiple-choice questions, it recommends that students eliminate unreasonable answer choices from consideration at the outset. It also introduces the standard grid that will be used to record the answers for the items that are not multiple-choice.

Because these items do not involve any complex computations, this Learning Project can also succeed in easing the students' fear about the GED Math test and instilling confidence that they can pass the test.

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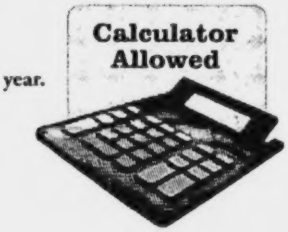
Inquiry Activity 1-1: Reading a bar graph

(Note: Italicized portions should be directed to students.)

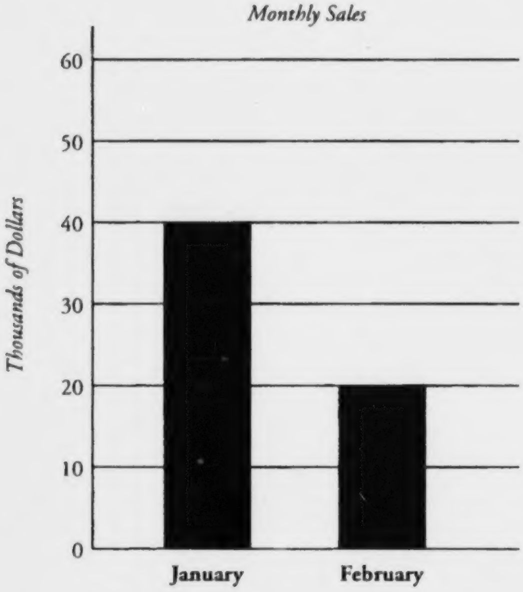
1. **Identifying the Problem (Item #1, PA) Calculator allowed.** (Teacher directed)

It is recommended that the following alternate question be used for this initial Inquiry Activity. It focuses only on the goals for this Learning Project, which should be relatively simple for most learners. It allows the learner to become familiar with the learning process before the mathematical topics get confusing. Later, in Learning Project # 5, you will re-introduce this stimulus using the original question about finding the average.



Read the question carefully, as you would if taking the actual test.

Kelly's goal is to average $25,000 per month in sales for the first three months of the year. Her sales for January and February are shown in the graph below.



(Alternate) question

What is the amount, in dollars, of her sales after these two months?

Mark your answer in the circles in the grid.

(Provide an answer grid on a separate sheet of paper.)

(Original Question: Do not use this one now unless you think your class can handle it this early in the class. You will return to this stimulus in Learning Project #5.)

To reach her goal, what is the minimum amount of sales Kelly must make in March?

1) $15,000
2) $24,960
3) $30,000
4) $35,000
5) $60,000

Here are some clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

You can't know what words the learner will choose here, but "average" is an important word.

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Eventually, the individual learner will be working alone on steps 1-3. However, you may want to guide the class for this first activity.

The following questions are general ones, recommended as first steps whenever a graph is being read. They are good questions to ask during test-taking as well.

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question. What are you being asked to find?

Read the title of the graph and the labels on the sides. What facts do the bars tell you?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

What is the problem asking you to do in terms of mathematics? Bring things together, separate things, or compare things?

The intent of this question is to make students aware of the different mathematical operations that certain kinds of situations demand. It will help them to know *when* to add, subtract, multiply or divide.

Find an answer.

Is your answer reasonable?

Be ready to defend your answer and the way that you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group, and explain why and how you found it and why you think yours is correct.*

Agree on the correct answer and the steps you would recommend for solving this problem. Include how you read the values from the graph. Write them as step 1, step 2, etc.

Write a mathematical expression that shows what your group did to find the correct answer.

***Whole class:** Report to the class the steps you decided to use in order to answer this question, as well as the mathematical expression that summarizes them.*

Take notes on any different ways that others used to find the answer.

Opportunities may arise here to talk about the Commutative Property of Addition,

20,000 + 40,000 = 40,000 + 20,000

(When you add, the order does not make any difference.)

or even the Distributive Property of Multiplication over Addition,

1000(20 + 40) = 20,000 + 40,000.

(You could add the 20 and 40 first and then multiply by 1000 or you could multiply each of them by 1000 first and then add them.)

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. (A group or instructor led activity)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

Lead a discussion of the elements in the structure of bar graphs by asking about this particular one. The title, vertical and horizontal scales, and the length of the bars combine to report the facts in a visual way. The length and position of the bars provide the connection between the axes. Ask if everyone had noticed that the vertical scale was in thousands of dollars - an important detail. Discuss the added impact that the visual graph has over listing the same data. For example, a viewer would notice immediately that the sales for January are greater (actually double) the sales for February, whereas that would not have been apparent when listed.

How did you know to add the numbers?

The question was asking to bring two things together.

What if the question had been, "How much more did she sell in January?" Write the mathematical expression that shows what you would have done to find the answer.

They should write, 40,000 – 20,000, making sure that it is in that order. (Subtraction is not commutative)

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

Supervise the groups as they scan through the newspapers and magazines in the classroom looking for other graphs that share the rectangular format (have vertical and horizontal axes.) Ask them to choose one of the graphs and answer questions similar to these.

List 3 facts that this graph is reporting.
What overall story does the graph tell?
Make up a question about this graph that might be on the GED test and exchange it with other groups to answer.

What are the average monthly sales for these two months?

You could also ask an additional question about this particular stimulus that would provide a foundation for Learning Project # 5 when they will see it again. Use their answers as a pre-assessment of their skills so that you can be prepared for that topic.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or did not benefit from the content and/or the methods to help you pass the GED test.

Remind the students that the 5-step process for solving the GED problems they have completed here will be repeated for the others that follow. Point out that steps 1 – 3 are also the steps they should follow when they are actually taking the GED test.

How did the test-taking and learning steps and procedures and 5-step format used in these Inquiry Activities work for your learning?

Which particular questions that were asked made you realize what you needed to do?

How could we make it work better?

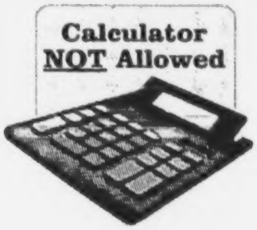
Inquiry Activity 1-2: Interpreting Significant Points on a line graph

(Note: Italicized portions should be directed to students.)

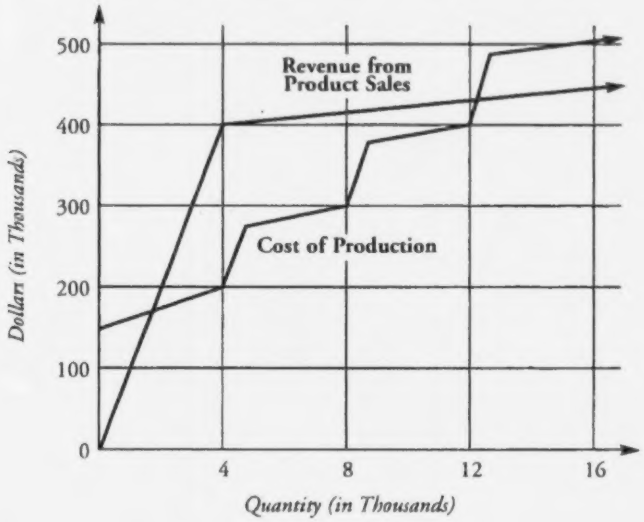
1. **Identifying the Problem (Item #20, PA) Calculator not allowed.** (Teacher directed)

Present this item exactly as it appears in the practice test.

Read the question carefully, as you would if taking the actual test.


Calculator NOT Allowed

Projected Cost and Revenue Functions For Solartex's Newest Computer Game



Question:

When none of the games has been sold, the revenue from sales will be zero. At the same time, the cost of sproduction is expected to be approximately $150,000. Why must this be true?

1) The game might not be popular at first.
2) The price of the game might not be too high at first.
3) Start-up money must be spent to produce the games.
4) The company may have decided to manufacture the game in small quantities at first.
5) The game might sell better if it is introduced at a different time of year.

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question. What are you being asked?

Read the title of the graph and the labels on the sides. What facts does the graph tell you?

What information in the graph is relevant to what you need?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

Eliminate unreasonable answer choices.

Find the answer.

Be ready to defend your answer.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

***Small Groups:** Compare your answer to others in the group and explain why you think yours is correct.*

Discuss your understanding of the meaning of the words: "production" and "revenue." Look them up in the dictionary to verify the meaning that they have in this question.

Locate the line on the graph that represents the cost of production and find the point that is being discussed in the question.

Agree on the correct answer.

***Whole class:** Report your group's answer to this question and indicate the point on the graph that is being discussed.*

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned.

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

The point that is discussed here intersects the vertical axis. If we were discussing the coordinate plane, it would be the y-intercept, the (0,b) of $y = mx + b$. In real-life applications, it corresponds to concepts like fixed costs, or in this case, start-up costs, which are incurred whether or not any items are produced or whether any time has passed. Make sure that the foundation of the concept is clear to the students; that is, when the number produced is zero, they have already spent $150,000.

Can you think of any other situations in your life that are similar to this one in that there is a charge or cost that you must pay up front?

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Often plumbers, electricians, or telephone repairmen charge a flat fee for showing up and then also charge an hourly fee for their work. Membership fees, such as those charged by some merchandisers or golf courses, might also be examples.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

This graph is more complex than the bar graph from the previous Inquiry Activity. Take some time to analyze it with the students, asking questions like these to make sense of the direction of the line representing cost and the trends that it indicates. The revenue line will be analyzed in the next item.

Follow the line that indicates the cost of production. It goes up as the number of games produced increases. Explain why that is reasonable.

When you consider the aggregate cost (not cost per item) it makes sense that the more you make, the more you have to spend for materials and labor.

What possible explanation can there be for the steep portions of the line?

It is possible that they would have to perform some periodic maintenance or even need to retool after a certain number of items have been produced.

Evaluating: Assess what you learned and how you learned it.

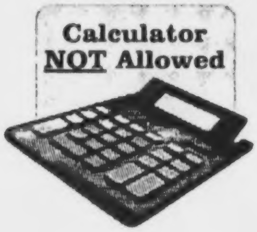
Reserve this step for after the second item in this set, which appears in the next Inquiry Activity.

Inquiry Activity 1-3: Interpreting Significant Points on a line graph

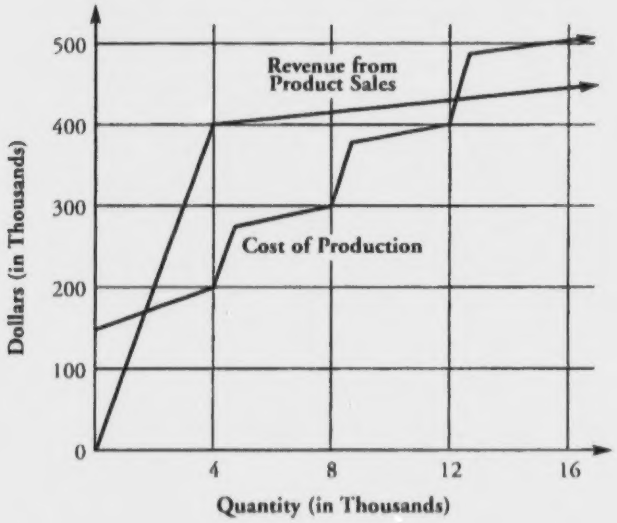
(Note: Italicized portions should be directed to students.)

1. **Identifying the Problem (Item #21, PA) Calculator not allowed.** (Teacher directed)

Read the question carefully, as you would if taking the actual test.



Projected Cost and Revenue Functions
For Solartex's Newest Computer Game



Question:

Based on market surveys, the cost of production is eventually projected to be greater than the revenue from sales. The graph shows that this is likely to occur after approximately how many games have been produced?

1) 2,500
2) 4,500
3) 8,500
4) 10,500
5) 12,500

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

The students are already familiar with this graph, but are being asked now to focus on a different point.

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question. What is this question asking you to find?

Expect that students will not be sure what they need to find at first. You could hint that they follow the line for production as they did in the previous item. Then re-read, "When is the cost greater than the revenue?" The question is asking how many games are being produced when that happens.

What information in the graph is relevant to what you need to find?

The intersection point is the key piece of information. They need to find the value on the horizontal axis that corresponds to that point.

3. Planning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

In your own words, determine what to look for in the graph.

Eliminate answer choices that are not reasonable.

Find the answer. Be ready to defend your answer and the way that you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain why you think yours is correct.*

Agree on the correct answer.

Locate the point on the line that is being discussed in the question. If this had not been a multiple-choice question, which number would you have used to approximate the answer? Agree on a good method to approximate a number like this one that falls between the lines on the axis.

Whole class: *Report your group's answer to this question and show your method to approximate the number.*

They will probably mention that they

1) Checked the numbers on the lines that are on both sides of the point, 12,000 and 16,000.
2) Found half the distance between the lines, labeled it 14,000, and then repeated that procedure to locate 13,000.
3) Since the point falls about halfway between the line for 12,000 and the mark for 13,000, its value is approximately 12,500.

5. Reflecting, Extending and Evaluating (whole class or groups)

Reflecting: Think about what you learned. (A group activity or instructor led.)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

It may be obvious to most that the points where the two lines intersect represent spots where the production costs and the revenue are equal. Equally obvious may be the fact that when the production line is above the revenue line, the production costs are greater than the revenue. These understandings, like that of the y-intercept, are fundamental to being able to interpret graphs of this kind. To ensure that each student does understand them, ask some other questions that relate.

At low levels of production, the cost is higher than the revenue. After the production and sale of approximately how many games will the revenue be greater than the costs?

It looks as if the point of intersection occurs about halfway between 0 and 4000, about 2000 games.

Over what range of production will this business be profitable?

It will be interesting to listen in on the discussions about what being profitable entails. They already know the numbers – between 2000 and 12,500.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and perhaps make new connections to other information.

Initiate a discussion in which the students come up with the fact that a business estimates its revenue by multiplying the number of items they expect to sell by the price they will charge per item.

Follow the line that indicates the revenue. It goes up as the number of games produced and sold increases. Explain why that is reasonable.

What possible explanation can there be for the bend in the line?

They must intend to sell the first 4000 games at a higher price than the remaining ones.

On the basis of the projections pictured in this graph, what advice would you give the manager?

They might advise the manager to stop making the games after 12,500, or to charge a higher price after 4000.

Evaluating: Assess what you learned and how you learned it. (individual)

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or did not benefit from the content and/or the methods to help you pass the GED test.

What have you learned about reading graphs that you think may be valuable to you in the future or when you are taking the test?

Which particular ideas about reading graphs are still confusing to you?

Inquiry Activity 1-4: Reading a line graph

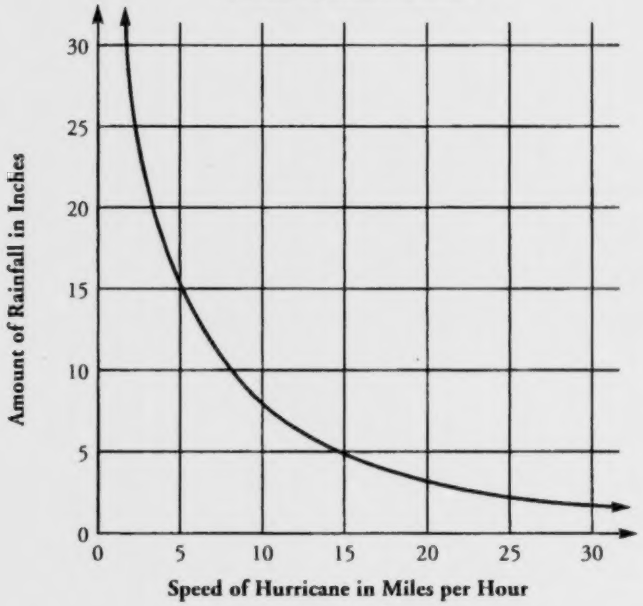
(Note: Italicized portions should be directed to students.)

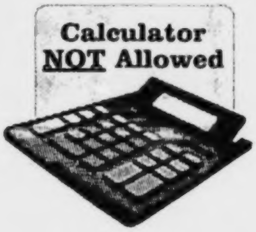
1. Identifying the Problem (Item #15, PA) Calculator not allowed.

Read the question carefully, as you would if taking the actual test.

15. The graph below shows the expected rainfall from a hurricane, based on the speed at which the hurricane is moving.

Expected Rainfall From A Hurricane





Based on the graph, what would be the approximate amount of rainfall, in inches, if a hurricane moves at 12 mph?

1) 15
2) 12
3) 10
4) 7
5) 4

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Ask yourself questions like the following about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question. What are you being asked to find?

Read the title of the graph and the labels on the sides. What are some facts that you can read from the graph?

3. Planning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following can be helpful.

In your own words, determine what to look for in the graph.

> They are looking for the number on the rainfall axis that is the value of the point that is on the graph directly above 12 on the MPH axis.

Estimate an approximate answer.

Eliminate answer choices that are unreasonable.

Choose the answer that is closest to your estimate. Be ready to defend your answer and explain your reasoning to your group.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group, explain how you found it and why you think yours is correct.*

Agree on the correct answer and a reliable step-by-step procedure to use when you are asked to estimate values that fall between the lines on a graph. You may want to consult the available textbooks. Remember that you will not be allowed to make any marks on the test itself.

Whole class: *Report your group's answer to this question, as well as the procedure that you recommend using in these situations.*

> Their procedure is likely to include three steps:
>
> 1) Approximate the position of the given value (12) on its axis.
> 2) Locate the point where the line of the graph intersects that position and follow its projection (perpendicularly) on the other axis.
> 3) Approximate the value of the point of intersection on the number line that serves as the other axis (nearly halfway between 5 and 10.)

Take notes on any different ways that others used to find the answer.

> You could suggest that they use the corner of a piece of paper to help them to maintain the perpendicularity necessary in step 2. Align one side of the paper to the given value (keeping it vertical) and then adjust the paper so that its corner falls exactly on the graph line. Follow the other side of the paper to the vertical axis.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. (A group activity or instructor led)

> ***Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.***

Remind the students of the graph in the previous Inquiry Activities. Ask questions like these so they see the connection between them.

What made this question more difficult than the previous one?

Most will recognize that it was more difficult because neither the 12 nor the 7 fell on the grid lines of the graph, so they had to estimate twice. You may want to tell them that this process, when applied to graphing, is called interpolation. Others might mention the curve of the line as being difficult for them.

Practice approximating values on this graph.

What is the expected rainfall when the speed of the hurricane is

5 mph?
8 mph?
17 mph?
28 mph?

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

A line graph is often used to visualize a trend. Ask questions like the following so that your students also focus on the story that the graph is telling.

In general, how does the speed of a hurricane affect the amount of rainfall? Explain how this makes sense to you.

As the speed increases, the rainfall decreases. They may say that a slower speed means that the storm stays around longer, with more time to drop the rain.

Complete the following table by estimating from the graph.

Hurricane Speed (Input)	*5*	*10*	*15*	*20*	*25*	*30*
Amount of Rainfall (Output)						

Notice that each number in the first row (input) is 5 units more than the one before it. Check to see if there is a similar pattern between the numbers in the second row (output). How much change in rainfall is there between the entries?

What is the greatest change and where does it occur?

Where does the least change occur?

Where is the line of the graph the steepest, between 5 and 10 or between 25 and 30?

Write a statement that connects the two ideas – steepness and amount of change.

The questions above distinguish between amount of rainfall (found by approximating values from the graph) and the amount of change in rainfall (visualized by the slope of the line in an interval). These ideas are important ones for understanding change in real life and are likely to be assessed on the GED test. This is only an introduction to the notion that they can read more from graphs than the individual data points. The ideas of rates and slopes will be revisited in LP #2 where rates are studied in mathematical expressions and in LP #7 where they will study how rates are pictured in a graph.

This particular line is in the shape of an exponential curve, where the rate of decrease varies. If the curve were a straight line, the rate of decrease would be the same throughout the graph.

Graphs that follow an exponential pattern are not very common in newspapers and magazines, even though this pattern is a common one for growth and decay. You should ask the students to search out and bring in similar graphs over the next weeks. Analyze the submitted graphs together focusing on the pattern of change.

What overall story does the graph tell?

During which period is the change the greatest? The least?

Make up your own GED test question about this graph that involves interpolation.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

How do you react to the presence of a graph in a newspaper article? For instance, do you usually ignore it or do you study it? Do you prefer to read the words or the graph to find out the facts? Explain your preference.

This bit of introspection may give the learner clues as to his learning style. We hope to capitalize on the visual learning style throughout our study of graphs in this course.

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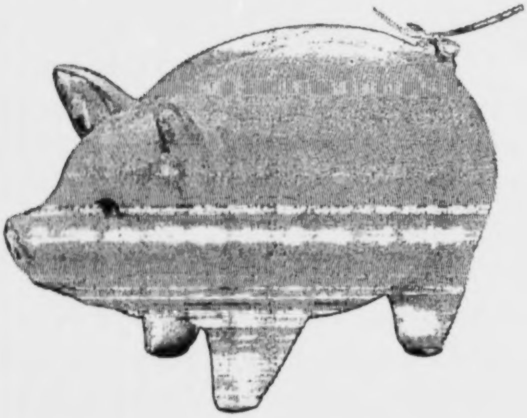
Learning Project

Rates



Introduction

The two problems in this Learning Project are practical, everyday problems with which the learners may have had some prior experience – comparing prices to determine how much is saved (Inquiry Activity 2-1) and calculating the cost of a truck rental (Inquiry Activity 2-2). Both of the Inquiry Activities attempt to build on prior experience the learners may have, as well as help them transfer the math knowledge gained to comparison-shopping situations. The approach to these multi-step problems asks the learners to indicate the steps they took to find the answers, in the same spirit as the process orientation of the activities themselves.

Inquiry Activity 2-1 presents the first problem in these Learning Projects in which the calculator can help, but is not necessarily needed, in the solution of the problem. Since the calculator is allowed, encourage its use as part of a test-taking strategy in double-checking an answer found by estimating or with paper and pencil.

Take time to point out the directions for calculator use that accompany the Practice Test, and ask each student to follow along with the first two examples. The learners should see that doing basic computations does not require any of the scientific functions on this calculator. Save the advanced topics in the last two examples for later when the concepts fit in with the discussion.

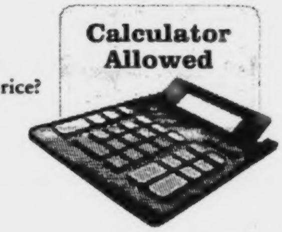
Learning Project Rates

Inquiry Activity 2-1: Multi-step Problems and Rates

(Note: Italicized portions should be directed to students.)

1. **Identifying the Problem (PA Test item # 7) Calculator allowed** Instructor directed.

Read the question carefully, as you would if taking the actual test.



7. Electric switches that regularly sell for $0.69 each are advertised this week at 5 for $2.75. How much is saved by purchasing 5 switches at the sale price rather than at the regular price?

(1) $6.20
(2) $3.45
(3) $2.75
(4) $0.70
(5) $0.14

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

What words and/or symbols are unfamiliar and what do you think they mean?

2. **Becoming Familiar with the Problem**

Ask yourself questions like these about the problem. Take note of the ones that were especially helpful so that you can remember to use similar thinking questions when you take the test.

Reread the question. What are you being asked to find?

Which information in the problem is relevant to what you need to find?

What do you know about this kind of situation: determining how much you can save when shopping?

3. **Planning, Assigning and Performing Tasks**

Try to answer the test question any way you can, even it you have to guess, but become aware of the reasoning and operations that you are using. The following directions and questions can be helpful as strategies to use solve test questions.

Planning

What is the problem asking you to do in terms of mathematics: bringing things together, separating things, or comparing things?

The intent of this question is to make students aware of the different mathematical operations that certain situations demand. It will help students to know when to add, subtract, multiply or divide.

Finally, this is a comparison situation, comparing the sale versus regular price of 5 items. But it is necessary to 'bring together' the 5 individual costs of $0.69 before comparing.

How many steps will it take to find the answer, what is the order of the steps, and what math will you perform at each step?

Most will see this as a two step problem: 1) multiply the regular cost of one switch ($.69) to find the cost of 5 switches at the regular price, and then subtract the cost of 5 switches at the sale price from 5 switches at the regular price.

Doing the Work

Represent the problem as a mathematical expression or equation that includes the steps and the math required at each step.

Estimate an answer – tolerate some fuzziness, but be aware of the steps you took to make the estimate, even if you guessed.

One of the estimation strategies might be to round the \$.69 to \$.70, and then multiply 5 x \$.70 which makes it \$3.50. The answer to the second step of subtracting can now be estimated at \$.75.

Eliminate unreasonable answer choices. Remember the reasoning process you used to eliminate some of the answer choices.

If they estimated as described above, only one answer choice makes sense. However, to encourage students to use their creativity while estimating and problem solving, we want to hear about their individual strategies in the sharing steps that follow.

Find the answer.

Compare your answer to the estimate.

Is your answer reasonable?

Be ready to defend your answer and the way you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain why and how you found it and why you think yours is correct.*

Come to an agreement in your group as to the steps you would recommend for solving this problem both with and without a calculator. Write them as step 1, step 2, etc.

Write a mathematical expression that shows what your group did to find the correct answer.

Write your answer in sentence form.

I would save \$.70 by buying 5 switches at the sale price of \$2.75, rather than paying \$3.45 for five switches at the regular price of \$.69 each.

Whole Class: *Report to the class the steps you decided on to answer this question as well as the mathematical expression that summarizes them.*

Take notes on any different ways that others used to find the answer.

Some may have divided the sale price of \$2.75 by 5 to find the price of 1 during the sale (\$.55). They could then subtract that from \$.69 to find the savings per item (\$.14) and finally multiply that by 5 to find the total savings. Using a calculator would make this method a viable alternative.

5. Reflecting, Extending and Evaluating

This activity can be an instructor-led discussion or done in pairs or small groups, whatever the learners feel more comfortable with. One underlying generalization to be made is that total cost is found by multiplying the number of items by the price per item. ($C = np$). A second observation is that subtraction is used here to compare the final costs – it provides the answer to "how much is saved?" Since this is the first item from the calculator section of the test that we are studying, this is the time to introduce its use and to explore students' feelings about using it.

Reflecting: Think about what you learned. (group activity or instructor led.)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

Explain the reason why you chose to multiply in solving this problem.

Mathematically speaking, multiplication is the operation that you use when you combine a number (5) of numbers that are the same (.69 or .14) In this situation, most have multiplied the number of items times the price per item to find the total cost.

All the methods that were used to solve this problem involved a final step of subtracting as a way to compare the costs. What words in the problem indicated to you that you needed to subtract?

Subtraction is one of the operations used to compare numbers. Here we want to know how much more one number is than the other (the difference between them) so we used subtraction.

Which way to solve the problem seems to be the most efficient way to you to solve similar problems when taking a test? Explain.

This discussion may take many paths, some choosing estimation and some the calculator method. The point should be made that using both in a test-taking situation is probably the safest.

What method are you most likely to use to solve a similar problem if you are at the store?

It will be interesting to see how many people in the class would estimate and how many would pull out the calculator.

Review the instructions for using the calculator supplied in the practice test. What more would you like to know about the use of a calculator for test-taking purposes?

This item is an example of many in the calculator section of the test that really does not require using it to find the answer. However, there will usually be ways to incorporate its use in justifying your answer or in making sense of the situation.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe making new connections to other information.

Suppose you need only one electric switch. Is it better to buy one switch at regular price or 5 switches at sale price? Explain, using numbers to support your position.

How is your experience with getting the best buy similar to or different from the situation that is presented in this problem? Explain.

What math do you use to get the best buy in stores?

From your shopping experience, make up at least one test question on comparing products to get the best value. Pass out your question for others in the class to solve.

Was there anything that you learned in the previous Learning Project on Graphs that helped you in this problem? Why or why not?

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***Evaluating:* Assess what you learned and how you learned it.**

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

How does your personal experience with trying to figure out best values for the money help you to solve test-questions like this one? Explain.

Are you developing any test-taking strategies yet? Explain.

What do you think of the steps for analyzing test questions that is outlined here: (1) Read carefully, (2) become familiar with the problem, (3) estimate an answer, (4) narrow down multiple choice answers, (5) do the work to find an answer, and (6) determine an answer?

How did these steps work for you in solving this problem?

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Learning Project Rates

Inquiry Activity 2-2: More Multi-step Problems and Rates

(Note: Italicized portions should be directed to students.)

1. **Identifying the Problem (PA Test item #16) Calculator not allowed** Instructor directed.

Read the question carefully, as you would if taking the actual test.

16. A company charges $60 per day plus $0.50 per mile for truck rentals. If Greg rents a truck for 3 days and drives it a total of 150 miles, what will the company charge?

(1) $110
(2) $135
(3) $230
(4) $255
(5) $300

Calculator NOT Allowed

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

What words and/or symbols are unfamiliar and what do you think they mean?

2. **Becoming Familiar with the Problem** (Instructor directed.)

Ask yourself questions like these about the problem. Take note of the ones that were especially helpful so that you can remember to use similar thinking questions when you take the test.

Reread the question. What is the question really asking?

Which information in the problem is relevant to what you need to find?

What do you already know about renting cars, trucks or other equipment?

3. **Planning, Assigning and Performing Tasks**

Try to answer the test question any way you can, even it you have to guess, but become aware of the reasoning and operations that you are using. The following directions and questions can be helpful as strategies to use solve test questions.

Planning

What is the problem asking you to do in terms of mathematics…bringing things together, separating things, or comparing things?

This is a bringing things together problem.

How many steps will it take to find the answer, what is the order of the steps, and what math will you perform at each step?

A multiple step problem, in which it is important that the cost of each service is brought together with the appropriate cost of that particular service: 1) The $60.00 per day must be multiplied by the number of days (3) to get the total cost of that part of the transaction (per day is a key term); 2) the $0.50 per mile must be multiplied by the number of miles driven (150) to get the total cost of that part of the transaction; and 3) add the two totals to get the final answer.

Doing the Work

Represent this problem as a mathematical expression or equation that includes the steps and the math required at each step.

Estimate an answer – tolerate some fuzziness, but be aware of the steps you took to make the estimate, even if you guessed.

Review the multiple-choice answers and eliminate some answers that seem unreasonable. Remember your reasoning so you can share it later.

Knowing that 3 days of rental will cost $60 per day, or $180 by itself, indicates that the first two multiple-choice answers can be eliminated.

Find the answer.

Compare your answer to the estimate.

Is the answer reasonable?

Be ready to defend your answer (whether you worked individually or with someone else) and the way you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain why and how you found it and why you think yours is correct.*

Without looking it up, tell what you think the meaning of the word, 'per' is in this problem.

Come to an agreement in your group as to the steps you would recommend for solving this problem. Write them as step 1, step 2, etc.

Share your estimation strategies with the others in the group. Choose one strategy to report to the whole class.

Write a mathematical expression that shows what your group did to find the correct answer.

Write your answer in sentence form.

Whole Class: *Report to the class the steps you decided on to answer this question, the mathematical expression that summarizes them, and the estimation strategy that you would recommend.*

Take notes on any different ways that others used to find the answer.

5. Reflecting, Extending and Evaluating

This activity can be an instructor-led discussion or done in pairs or small groups, whatever the learners feel more comfortable with.

Reflecting: Think about what you learned. (group activity or instructor led.)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

This item was NOT in the calculator section of the test. Analyze your work in setting up and solving this problem, noting those steps where the calculator would have been helpful to you and where it was not.

Explain why multiplication was suitable for the first two steps and addition for the last.

From the last item, many should remember that multiplication brings together a number of numbers that are the same while addition brings together numbers that are different.

How would you have figured the total amount if you were actually renting a truck?

Most would wait for the bill to be presented to them by the clerk. Others could point out that you need to have an estimate in your mind, so that you can tell whether the total is reasonable.

Which factors, other than price, are important considerations for you when renting a vehicle?

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

What if the question had told you that Greg had traveled 150 miles and that he was charged $75 for mileage. How would you have found the rate per mile?

This question is an example of how division undoes multiplication and can also serve as a warning to those who are used to finding key words, like 'per' and thinking that it will always mean that they will multiply.

What did you learn in the last Inquiry Activity that helped you solve this problem?

How is this problem different from the problem in the last Inquiry Activity? How is it the same?

Make up at least one test question on providing and charging for services that are similar to this problem. Pass out your question for others in the class to solve.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Make a note of any computation difficulties that this item exposed and arrange to practice if you need it.

How were you able to keep sets of related numbers together so that you can do the proper calculations with them? What were the clues that you used?

It is important that the amount of each service is brought together with the appropriate cost of that particular service: 1) The $60.00 per day must be multiplied by the number of days (3) to get the total cost of that part of the transaction; 2) the $0.50 per mile must be multiplied by the number of miles driven (150) to get the total cost of that part of the transaction. The word 'per' is key to keeping them straight.

Think back on how you figured out how to solve this problem. If a friend asked you what was the most important thing to remember while problem solving, what would you say?

Learning Project

Algebra/Variables

Introduction

The activities in this Learning Project introduce the algebraic concept of using variables. The first two Inquiry Activities (3-1 and 3-2) force the students to generalize about the arithmetic idea of rates by using variables. Since these are multi-step problems similar to those that they have just studied, they should help to develop a clearer understanding of the previous project as well. These two items are set-up items where the answer choices are equations that describe processes rather than final numerical answers. The last item (3-3) using variables in a geometric formula, provides an opportunity for the two disciplines, algebra and geometry, to enhance the understanding of each other.

Throughout this activity and the next, you may encounter student anxiety about the idea of algebra. While students should be able to discuss their fears openly, they should not contaminate the class with negativity. The elements of algebra that are needed for the GED test involve some abstraction but focus on the practical uses of being able to use symbols in problem solving. As a result, your anxious students should be pleasantly surprised to find themselves working easily with variables.

Algebra's bad reputation with most students seems to arise from what they see as isolated rules that make no sense. While there are rules involving notation and symbol manipulation that they will see in these projects, solid reasoning stands behind them. Take the time to build a solid, sense-making foundation during this project so that your students can progress without additional anxiety.

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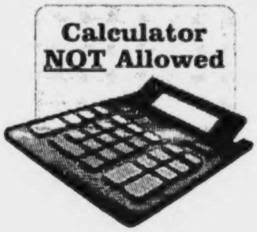
Learning Project Algebra/Using a Variable

Inquiry Activity 3-1: Introduction to variables

(Note: Italicized portions should be directed to students.)

1. Identifying the Problem (Item #19, PA) Calculator NOT allowed (Teacher directed)

Read the question carefully, as you would if taking the actual test.



19. To rent a ball field for a game costs a $300 basic fee, plus a $2 fee per person. If x persons attend the game, which equation can be used to find T, the total cost of renting the ball field?

$T = 2x + 300$

$T = 300x + 2$

$T = (300 + 2)x$

$T = \frac{300+2}{x}$

$T = (300)(2x)$

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question. What is it asking you to find?

It is not asking for an answer in the traditional sense. The equation is just a step-by-step plan of what to do.

What information in the problem is relevant to what you need to find?

What do you know about this?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

What is the problem asking you to do in terms of mathematics? Bring things together, separate things, or compare things?

This situation brings things together.

Substitute an easy number for x to figure out the relationship. (For example, if the number of people, x, were 20, what would the cost be? Remember the step-by-step process that you used to find it.)

Choose an answer. (Which equation describes the process that you used above?)

Is your answer reasonable? (Check it by using x = 20 again)

Be ready to defend your answer and the way that you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain why and how you found it and why you think yours is correct.*

Agree on the correct answer choice and be ready to explain the step-by-step process that the equation describes. If necessary, check textbooks for instruction on algebraic notation (for instance, what does 2x mean?) and unfamiliar vocabulary (for example, equation).

Whole class: *Report your answer choice and the process that the equation describes to the whole class. Show that when you use a number instead of x, you find an answer that makes sense.*

5. Reflecting, Extending and Evaluating.

This discussion should ease the students' anxiety about algebra. Substituting an easy number for the variable as suggested above illustrates a common use of a variable, a letter used in place of a number when the number is unknown or when it can change. In the GED test, one can often figure out the answers to the algebra problems without studying formal algebra if they understand how variables are used.

Reflecting: Think about what you have learned. *(group or instructor led.)*

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

This item is in the no-calculator section of the test. Explain if and how using a calculator could have been helpful to you.

Ask this question to raise the students' awareness that mathematics involves more than computation. Most will probably answer that they don't think the calculator would have been helpful since there was no computation involved in choosing the answer. A few might say that they could have used it to explore the patterns of each of the equations.

In the expression, 2x + 300, there is nothing between the 2 and the x. What does this mean in algebra? Explain how this operation between the 2 and the x makes sense in the problem situation, by connecting it to the rate activities in the last project

When there is no sign between a number and a variable or between two variables, it signifies multiplication. In this situation, $2.00 is charged for each person, so 2 needs to be multiplied by the number of people (x).

The variable, x, is a letter that is used in place of a number that can change. When x has a value, you can figure out what the value of T is by following the steps that the equation describes. For instance, if 100 people attend the game, what is the total cost? Fill in the following table:

x	*2x + 300*	*T*
100	*2(100) + 300*	*500*
0		
50		
80		
150		

Answers for instructors: *0 input results in 300 Total*
50 input results in 400 Total
80 input results in 460 Total
150 input results in 600 Total

It seems as if the $300 basic fee will be charged even if no one shows up for the game. In which Inquiry Activity have you talked about this idea before? Explain the connection.

In item 20 (Inquiry Activity 1-2 in Learning Project #1,) you focused on the y-intercept on the graph, the point that corresponds to the value of the output when the input is zero. If the function $T = 2x + 300$ were graphed, 300 would be the y-intercept because it is the value of T when $x = 0$.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe making new connections to other information.

***Small groups**: Look at the other answer choices in this item. Discuss the processes you think each of the equations is describing. Substitute 100 for x and figure out what the value of T would be in each equation. Which, if any, are reasonable amounts? Report your conclusions to the class.*

In 2) $T = 300x + 2$, the number of people is multiplied by 300 and then 2 is added. If x is 100, T would be $30,002.

In 3) $T = (300 + 2)x$, 300 and 2 are added first and that answer is multiplied by the number of people. If x is 100, T would be $30,200.

In 4) $T = \frac{300 + 2}{x}$, 300 and 2 are added first and then divided by the number of people. If x is 100, T is $3.02

In 5) $T = (300)(2x)$, the number of people is multiplied by 2 and that answer is multiplied by 300. If x is 100, T is $60,000

Let n represent a number. Write a mathematical expression for:

a) 10 times the number
b) 5 more than the number
c) the number divided by 7
d) 3 less than the number

a) $10n$ or $n(10)$
b) $5 + n$ or $n + 5$
c) $n/7$
d) $n - 3$

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Describe your feelings about the algebra that you learned in this activity.

Pinpoint, if you can, the particular thing that you still do not understand from this activity. Keep it in mind as you do the next activities in the project, looking for the insight that will make things clear.

If you want it, ask your instructor to recommend some practice for you.

Learning Project ☐ Algebra/Using a Variable

Inquiry Activity 3-2: More variables

(Note: Italicized portions should be directed to students.)

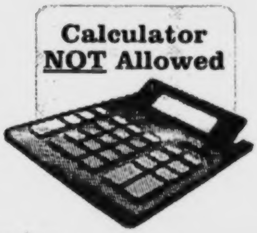
1. Identifying the Problem (Item #24, PA) Calculator not allowed (Teacher directed)

Read the question carefully, as you would if taking the actual test.

24. Carpenters earn an average of $1120 less per month than designers at a furniture factory in Smithville. The factory employs 3 designers and 15 carpenters. Let x represent the average monthly pay of a designer.

Which of the following functions correctly shows the relationship between the monthly payroll (P) and the wages of these employees?

1) $P = 3x + 15(x - 1120)$
2) $P = 3(x - 1120) + 15x$
3) $P = 3(x - 1120) + 15(x - 1120)$
4) $P = 3 + x + 15 + (x - 1120)$
5) $P = 3(x)(15)(x - 1120)$



Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question. What is it asking you to find?

What information in the problem is relevant to what you need to find? (Take notes to organize the information.) What do you know about this?

3. Planning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

What is the problem asking you to do in terms of mathematics? Bring things together, separate things, or compare things?

This situation brings things together in a monthly payroll.

Substitute an easy number for x to figure out the relationship.

Hoping that the students remember this step from the last activity, we won't give any hints this time. If a student is stumped, you might get him moving by asking what the amount of the payroll would be if a designer earned $4000 a month.

Choose an answer. (Which equation describes the process that you used above?)

Is your answer reasonable?

Be ready to defend your answer, the way that you found it, and its reasonableness.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group, and explain why and how you found it and why you think yours is correct.*

What does (x – 1120) represent in the problem situation?

Since x represents a designer's pay, (x – 1120) represents a carpenter's pay.

Agree on the correct answer choice and be ready to explain the step-by-step process that the equation describes. Discuss each mathematical operation in the equation and give a logical explanation for using it. If necessary, check textbooks for instruction on algebraic notation.

Since they have now discussed WHEN to multiply and add in the last 3 items, they should be ready to offer the explanation themselves.

Whole class: *Report your answer choice and the process that the equation describes to the whole class. Give a reason for using each operation when you did. Show that when you use a number instead of x, you find an answer that makes sense.*

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you have learned. *(group or instructor led.)*

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

What do the parentheses around (x – 1120) tell you to do?

Generally speaking, it tells you to consider what is inside as a single quantity. When you are evaluating this expression, the parentheses tell you to do this subtraction before you multiply.

How did the mathematical equation tell you to multiply?

When the variable, x, was next to the 3, it meant 3 times x.

When there was no sign between the 15 and the parentheses, it meant to multiply 15 by the quantity in the parentheses.

The expression, x – 1120, describes a number that is 1120 less than whatever x is.

Complete this table:

Designer's pay x	*x – 1120*	*Carpenter's pay*
3000	*3000 – 1120*	*1880*
3550		
4000		
4550		
5000		

Answers for instructors:
3550 input results in 2430 Carpenter's pay
4000 input results in 2880 Carpenter's pay
4550 input results in 3430 Carpenter's pay
5000 input results in 3880 Carpenter's pay

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Connect the idea of 'rate' in this situation to other situations you have studied in other activities. Note the similarities and differences.

In this item, they multiplied the number of designers by the pay of one. In the previous activity they multiplied the number of people by the fee for one. Similarly, in the previous Learning Project, they multiplied the number of days by the charge for one day.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe making new connections to other information.

Small groups: *Use your calculator and the numbers in the table above to show that (x – 1120) is not the same as (1120 – x). For example, enter 1120 – 3000 into your calculator and compare the answer to the one above. Repeat with the other numbers and state your conclusion.*

Make up a problem (including 5 answer choices) similar to this one that involves purchasing 3 cans of soup and 5 bottles of soda. Your problem should state that a bottle of soda costs $2 less than a can of soup, but should not specify what the soup costs. Share your problem with the class.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

What progress have I made toward my personal math goals?

What do I need to spend more time on?

If you want it, ask your instructor to recommend some practice for you.

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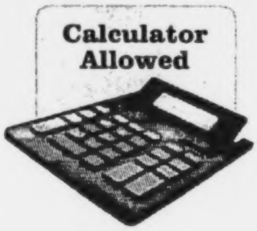
Learning Project 3 Algebra/Using a Variable

Inquiry Activity 3-3: Variables and Measurement

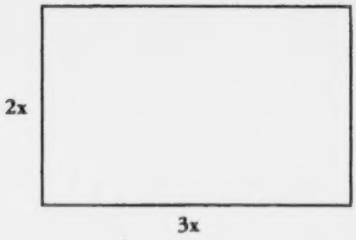
(Note: Italicized portions should be directed to students.)

1. **Identifying the Problem (Item #11, PA) Calculator allowed** (Teacher directed)

Read the question carefully, as you would if taking the actual test.



11. The dimensions of the rectangle shown below are 2x and 3x



How many square units are in its area?

1) 12
2) 5x
3) 10x
4) $5x^2$
5) $6x^2$

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

What words and/or symbols are unfamiliar and what do you think they mean?

2. **Becoming Familiar with the Problem**

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question. What is it asking you to find?

What do I know about this? (Finding area of a rectangle? What to do with the 'x'? The meaning of the little 2?)

Sketch a picture of what is going on. (Divide the rectangle into square units and label them.)

3. **Planning, Assigning and Performing Tasks**

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

Substitute an easy number for x to figure out the relationship. (For example, if x were 5, how would you find the area?)

What is the problem asking you to do in terms of mathematics? Bring things together, separate things, or compare things?

If they drew sketches, dividing the rectangle into squares is separating but the final step is to bring the two rows of squares (the area of each is x^2) together. $2 \times 3(x^2)$

Find an answer.

Is your answer reasonable? (Check it by using x = 5 again.)

Be ready to defend your answer and the way that you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

***Small Groups:** Compare your answer to others in the group and explain why and how you found it and why you think yours is correct.*

Discuss the sketches that were made by individuals in your group. How are they alike or different? Did they all logically lead to the same answer?

Agree on the correct answer and the steps you would recommend for solving this problem. Write them as step1, step 2, etc.

Write a mathematical expression that shows what your group did to find the correct answer.

***Whole class:** Report to the class the sketches you drew, the steps you decided on to answer this question, and the mathematical expression that summarizes them.*

For those groups who used the area formula, listen for their explanation of why the answer included an x^2. This will likely be a topic for the reflection step.

Take notes on any different ways that others used to find the answer.

For discussion purposes, we hope that some groups reasoned out the answer without just plugging the numbers into the formula. Since the correct answer choice is the only one with a 6, some may have just made the choice based on that alone. (A curse on multiple-choice!)

5. Reflecting, Extending and Evaluating

***Reflecting: Think about what you learned.** (A group or instructor led.)*

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

Refer both to the geometry and the algebra of this item even though you will be repeating the geometry emphasis in the geometry LP on areas and perimeters. Throughout this discussion you should stress the importance of understanding the basis of a formula before using it. The sketches that were drawn will provide the starting point. This is a critical phase. Start with the idea that area is surface and is measured using square units. Visualizing the rows and columns of squares provides a touchstone for understanding what multiplication does and why you multiply the length by the width when finding the area of a rectangle. Choose questions like the ones below that will clarify and amplify what the students have contributed already.

Study the different sketches that students drew. How has the variable x been used? What does x^2 mean in the answer? If x was not used in the sketch, how could it have been used? Show that your answers make sense if $x = 5$.

We would like the students to conclude that each square unit that they have drawn is x units wide and x units long, and thus has an area of x^2, or x X x, square units.

Compare the procedure that is suggested by your sketches to the formula for the area of a rectangle that is found on the formulas page that will be included in every GED math test. Now use the formula (substituting 3x and 2x for length and width) to find the answer. Explain what x^2 means mathematically. Check your explanation of the notation with what you can find in a textbook. Note any new vocabulary.

A strict mathematical procedure would start with $(3)(x)(2)(x)$, considering each factor separately. Because these are all being multiplied and multiplication is commutative, you can rearrange them into $(3)(2)(x)(x)$. Next you would multiply the numbers to get 6 and the variables to get x^2. Help your students to see that the sketch procedure actually explained what the algebra of multiplying variables means.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe making new connections to other information.

You could ask and discuss, "What if they had asked for the perimeter of the rectangle?" here or in the geometry Learning Project. If a student brings it up here, go ahead, but we suggest that you save it for later. Focus on the algebra ideas that surface here.

In this item, you learned what x^2 means. What would the value of each of the following expressions be if $x = 4$?

a) x^2
b) $5x^2$
c) $(5x)^2$
d) $2x^2 + 7$
e) $(2x)^2 + 7$

Answers for instructors:
a) 4 x 4= 16
b) 5 x 16 = 80
c) 20 x 20 = 400
d) 2 x 16+7 = 39
e) 8 x 8+7 = 71

Look in the available mathematics textbooks to find out what x^3 means. Then look up the formula for the volume of a cube on the formulas page provided with the GED test. How would you find the volume of a cube whose edges are 6 inches long?

6x6x6 = 216 cu in

Evaluating: Assess what you learned and how you learned it.

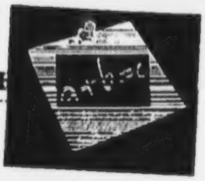
In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Compare your feelings about algebra now to the way you felt about it before this Learning Project.

What strengths of mine were apparent during this project?

What more would you like to know about equations, math symbols, etc.?

Do you need more practice in any of the math discussed in this Learning Project?



Learning Project

Algebra/Using Equations

Introduction

These Inquiry Activities take the learners to the next step of algebra, in which they solve an equation for x, which they should now understand is a variable. Their success in the last Learning Project should have built a common sense understanding of algebraic symbols and contexts to help them have confidence in approaching these next few problems.

This Learning Project introduces the learner to inverse operations (undoing one with another), used when isolating the unknown on one side of an equation. They also learn the importance of balancing out the two sides of an equation so that they remain equal, and breaking down complex algebraic sentences into smaller more manageable parts. The students can also expand their knowledge and use of the GED Casio calculator functions and practice the correct use of the standard grid.

Again, manage the negative reaction to algebra that you may find in some students, so that it does not contaminate the class. As in any problem we face in life, breaking it down into smaller steps, taking it one step at a time, with help, insight and humor from our friends and colleagues can make any problem workable and bring success. It is also true that it takes time to feel comfortable with unfamiliar concepts. Since there will be opportunities in later Learning Projects to reinforce the concepts that are discussed here, do not insist on complete comprehension before you move on to other things.

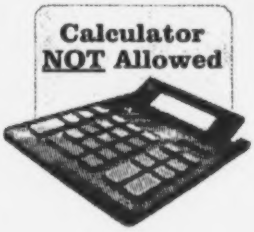
Learning Project Algebra/Using Equations

Inquiry Activity 4-1: Solving an Equation

(Note: Italicized portions should be directed to students.)

1. **Identifying the Problem (Item #19 - Alternate Question, PA) Calculator not allowed.**
   (Teacher directed)

   Read the question carefully, as you would if taking the actual test.



   19. To rent a ball field for a game costs a $300 basic fee plus a $2 fee per person. This cost structure is described by the equation, $2x + 300 = T$, where T represents the total cost and x is the number of people attending the game. If the total cost for renting the field was $550, how many people attended the game?

   Mark your answer in the circles in the grid. (The instructor should be prepared to handout an answer grid for this Inquiry Activity)

   Here are some problem clarification questions you may want to consider when reading test questions.

   What words and/or symbols might be important to understand to answer this problem and what are they telling you?

   What words and/or symbols are unfamiliar and what do you think they mean?

2. **Becoming Familiar with the Problem**

   On your own, ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

   Re-read the question.

   What is it asking you to find in this version?

   What information is relevant to what you need to find?

   What do you know about this?

3. **Planning, Assigning and Performing Tasks**

   Try to answer the test question any way you can, on your own, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

   What is the problem asking you to do? Bring things together, separate things, or compare things?

   Since you already know the total, this problem is asking you to separate.

   Find an answer, work out the problem any way you can, but remember the steps that you took.

   Is your answer reasonable? (Check it by substituting your answer for x.)

   Be ready to defend your answer and the way that you found it.

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4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

Small groups: *Compare your answer to others in the group and explain why and how you found it and why you think yours is correct.*

Some students may "puzzle it out" by subtracting 300 from 550 and dividing the answer by 2. Tell them to "hold this thought" until we get to the Reflection section, where we will build on this concept. The formal algebraic procedures are not expected.

Agree on the correct answer choice and be ready to explain the step-by-step process that makes the most sense to you.

Most students are likely to talk about two steps:
Step 1 is to subtract 300 from 550 to get 250.
Step 2 is to divide that answer, 250, by 2 to get 125.

Using several answer grids, bubble in the answer in as many ways as you can.

Instructor- hand out blank grids.

Whole groups: *Report your answer choice and the different processes your small group members used to find this answer.*

Ask another member to report on the various ways the answer can be written in the standard grid.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. *(A group or instructor led.)*

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

The aim of the following questions is to lead the students to discover that the steps they took when they puzzled out the answer are the opposite or inverse of the steps that are indicated in the equation that was included.

Remembering what you learned in the previous Learning Project, tell in your own words what the left side of the equation $2x + 300 = 550$ *tells you to do mathematically.*

Note that 550 has been substituted for T in the equation because it was given in the problem. It says to multiply x (the number of people) by 2 and then add 300.

Look back at the operations you used in the steps you recommended when you found the answer. How do those operations compare to the operations that are indicated in the equation?

Subtraction and division were used, whereas addition and multiplication were indicated in the original equation. Not only are they opposite operations, but they are done in the opposite order.

Now let's look at a simpler example: If you had 100 apples and had to divide them among 50 children, what operation would you use to decide how many apples each child receives?

Division : $100 \div 50$

...and how would you check your answer?

Multiply $2 \times 50 = 100$.

How is this simple example similar to how you have worked this problem?

In this problem, they subtracted and then divided to find the answer. However, when they checked to see if the answer made the equation true ($2(125) + 300$ does equal 550) they multiplied and then added. The property of inverse operations, or "undoing" can be discussed at this point. Addition undoes subtraction, and multiplication "undoes" division, etc. Math is very neat and the pieces fit together perfectly, when you can reason it out. Another point the students may bring up is that difficult problems are often easier to understand when students can substitute very easy numbers and work them as they would in everyday situations.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

These exercises reinforce the idea of opposite operations but also use the idea of checking their answers to show that when you solve an equation you find the number that makes it true.

Small groups:

In the problems that follow, x represents an unknown number. Try to solve these problems in your head without using a pencil if you can. Then, discuss how your mental math involved undoing the operations (using its opposite or inverse).

a) $x - 6 = 2$
b) $30 - x = 10$
c) $50 + x = 75$
d) $x + 20 = 90$
e) $5x = 15$
f) $100 \div x = 25$

Now, write the mathematical sentence for how you solved them and then show that the answer you found made the original equation true. Share your reasoning with the whole group.

a) $x = 8$: by thinking $2 + 6 = 8$ and checked by $8 - 6 = 2$
b) $x = 20$: by thinking $10 + 20 = 30$ and checked by $30 - 20 = 10$
c) $x = 25$: by thinking $75 - 50 = 25$ and checked by $50 + 25 = 75$
d) $x = 70$: by thinking $90 - 20 = 70$ and checked by $70 + 20 = 90$
e) $x = 3$: by thinking $15 \div 5 = 3$ and checked by $5(3) = 15$
f) $x = 4$: by thinking $25 \times 4 = 100$ and checked by $100 \div 4 = 25$

Share and compare the answers you came up with, in your small group, or with the whole group.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

How do you think understanding inverse operations could help you in everyday life? On the job? (Think about the apples and children example.)

For most people, adding and multiplying continue to be easier than subtracting and dividing. By using the idea of opposite operations and "fact families," they can turn difficult problems into easier ones.

If you want it, ask your instructor to recommend some practice algebra equations for you to solve.

Does algebra seem less mysterious now, and more practical or logical? If so, why?

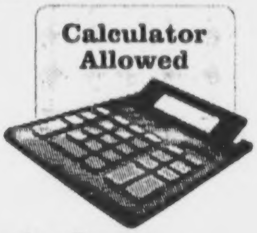
If not, listen to others' answers and discuss as a group.

Learning Project Algebra/Using Equations

Inquiry Activity 4-2:
Solving Equations and using Inverse Operations

(Note: Italicized portions should be directed to students.)

1. **Identifying the Problem (Item #3, PA) Calculator Use Allowed.** (Teacher directed.)



Read the question carefully, as you would if taking the actual test.

3. If 3x - 6 = 12, what is the value of x?

Mark your answer in the circles in the grid on your answer sheet.

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

What words and/or symbols are unfamiliar and what do you think they mean?

2. **Becoming Familiar with the Problem**

On your own, ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question. What is it asking you to find?

The value of x, a number that, if used in place of "x", will make the equation true.

What do you know about problems like this?

3. **Planning, Assigning and Performing Tasks**

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful. This may be done individually or in small groups.

Figure the answer in your head and/or using pencil and paper, remembering all the steps you used.

Some students will puzzle out this answer, similar to Inquiry Activity 4-1, using common sense and trial and error (3 times what? minus 6, is 12?) Others who may understand some algebra principles may say 3x - 6 + 6 = 12 + 6 and then, 3x = 18, and then, 18 / 3 = 6, but that would be advanced for most students.

Think about how you could have used the calculator in this problem. Be ready to share your ideas.

Is your answer reasonable?

Bubble in your answer in the answer grid provided.

Be ready to defend your answer, how you found it, both without a calculator and with one, and the way you bubbled in your answer on the answer grid.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

Small groups: *Compare your answer to others in the group and explain why and how you found your answer, and why you think it is correct.*

There should be several ways to think about this equation.

Agree on the correct answer choice and come to an agreement on what you believe is the best way to approach it. Choose a reporter to explain your approach step-by-step to the whole group.

Using several answer grids, bubble in the correct answer in several ways. Choose another reporter from your group to show the various ways this number may be placed in the grid, and still be acceptable on the test.

Whole groups: *Report your answer choice, method, and how the answer was bubbled in for your group.*

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. *(A group or instructor led.)*

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

The purpose of the following discussion is for the learner to connect the idea of undoing, using opposite operations that the learners learned in the previous activity, with the new idea of balancing equations. Since this item is purely symbolic, they do not have a real situation giving hints as to what to do. You should make every effort to connect their common sense ideas from the last item to the formal rules of equations in algebra that are used here. As always, use the questions below that best fit the level of understanding that your class has shown in their responses to the item.

In mathematical terms, your answer of 6 is called the solution to the equation, $3x - 6 = 18$*, and the process of finding it is called solving an equation. Focus first on the word equation. What is the root of the word equation?*

Equal.

In your own words, what is the equation $3x - 6 = 18$ *telling (or asking) you?*

It is telling you that the expressions on both sides of the equals sign are equal. It is asking you which number will make that a true statement. The bottom line boils down to "What is x?"

Complete this sentence in your own words. "To solve an equation, ... "

To solve an equation, find the number that makes it true. Or, find out what x is.

How do you know when you are finished solving an equation?

You are finished when you know what x is, in this case, when you know that "$x = 6$". You should write this final equation so that everyone sees that this is the goal of solving an equation, noting that the variable, x, is all alone on its side of the equation.

So, let's look at a process we can use to keep the two sides of an equation balanced while we try to get to the bottom line, that is, x = *some number.*

To make this easier to follow, imagine there is a seesaw which is perfectly balanced, with 3 kids sitting happily on side A, and 2 on side B.

Side A 0 0 0 = 0 0 Side B

^

On side A one child weighs 70 pounds and the other two weigh the same amount, but you don't know how many pounds they weigh. On side B, the other side, the children weigh 70 pounds and 80 pounds. What do you think the two children on Side A have to weigh to make the seesaw perfectly balanced?

Review the drawing above. Write an equation over the drawing that shows the 2 balanced ends of the seesaw. Use "x" to represent the unknown weight.

Students can label the picture to come up with: 70 + x + x = 70 + 80 or 70 + 2x = 70 + 80. Be sure to mention that when x is used twice in the same equation, it stands for the same number in both places.

To find the answer to the see-saw situation as well as the equation, our goal is to get the unknown quantity alone on its side, while remembering to always keep the seesaw (and the equation balanced). For example, if the two 70-pound children hopped down from each side, would the seesaw still be balanced? Why?

The answer is "yes, because you've taken the same weight off from each side, so the remaining weights must still be equal.

Work with each other to write the new equation that describes this new picture. Share with the whole group.

Subtracting 70 from both sides of the equation, 70 – 70 + x + x = 70 – 70 + 80 leaves x + x = 80 or 2x = 80

So what must the two children on the left side each weigh?

40 pounds.

Check your answer by using it instead of x in all the steps.

70 + x + x = 70 + 80
70 - 70 + x + x = + 70 – 70 + 80
x + x = 80
x = 40

Wrap up the reflection piece with a look at the original problem, recognizing that adding the 6 to both sides and then dividing both sides by 3, in order to get the variable on one side, has the same effect.

Start with the equation in this item, 3x – 6 = 12, and solve it by this method. At every step, explain what you are doing.

3x - 6 + 6 = 12 + 6 (adding 6 (opposite of subtracting 6 that is shown) to both sides of the equation, trying to get the variable alone, but taking care to keep the equation balanced)
3x = 18
3x/3 = 18/3 (dividing both sides by 3 (opposite of multiplying x by 3))
x = 6

Students should reference using inverse operations to undo the multiplication with division in this step, as learned in the previous Inquiry Activity.

Discuss with the class.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

Small Groups: *Go back through this problem and use the calculator to solve it. Record each step you do, the order in which you do it, and the numbers you punch into the calculator.*

Read the instructions for calculator use that comes with the Practice GED test. (Your instructor will pass out the instructions.)

Follow the instructions provided there and determine if these instructions are helpful in solving this problem with a calculator.

Individually: *Research algebra equations in your resource books that match these types of problems. In addition to the purely numerical problems, find a few word problems. Solve a few sample problems, reminding yourself of what you are doing and why.*

They should know that they are getting the variable by itself by using the opposite operation than what is originally shown and taking care to keep the equation balanced by doing the same thing to both sides.

Make up similar equation problems on your own.

It will be interesting (but more difficult to check) if the students make up equations where the answer is a fraction. If your class is shaky on the concepts, you may want to avoid this complication for now.

Small groups: *Trade your problem you found with a partner, and solve and discuss each other's sample problems.*

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Which do you like better: solving algebraic equations from just numbers, or with word problems and a real-life situation? Why?

When does the calculator help most with these types of problems?

Have you been able to do any mental math with some of the steps in this Inquiry? If so, what is the advantage? If not, what can you do to become more comfortable with mental math?

... such as $3x = 18$, $x/3 = 18/3$, $x = 6$

Inquiry Activity 4-3
Evaluating and Solving Equations

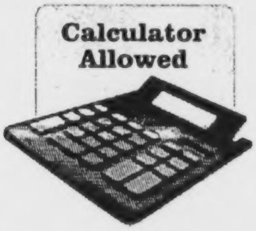
(Note: Italicized portions should be directed to the students)

1. Identifying the Problem (Item #9, PA) Calculator Use Allowed

Read the question carefully, as you would if taking the actual test.

9. The standard formula used by mechanics to find the length (L) of a fan belt of a car is as follows:

$$L = 2C + \frac{11(D+d)}{7} + \frac{(D-d)^2}{4C}$$



where D and d are the diameters of the wheels around which the belt runs, and C is the distance between the centers of the wheels.

What is L (in inches) if D = 12 inches, d = 2 inches, and C = 25 inches?

1) 39
2) 73
3) 97
4) 121
5) 229

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question.

What is the question asking you to find?

The length of a fan belt (L).

What information in the problem is relevant to finding the answer?

All you need is the formula and the numbers to substitute. The context is not a critical factor.

What do you know about finding answers to this type of problem?

They know about equations, parentheses, and exponents – in simpler formats.

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions and strategies can be helpful.

Use your experience with similar problems to make sense of this one.

Rewrite the equation, substituting the numbers for each variable.

Break the problem up into simpler parts.

Read the directions for the calculator accompanying the GED Math test (which you instructor will provide) and determine if anything there helps you to use the calculator to solve this problem.

Find the answer and record the steps you used.

Check for the reasonableness of your answer.

Choose one of the answer choices.

Once you've chosen an answer, be ready to defend the way you found it.

(I am told that it would be very unusual if a fan belt were this long, so be prepared for some discussion here.)

Note: At some point in "Performing Tasks," your assessment may reveal that certain knowledge gaps may need attention. However, allow each student to complete as much of the problem as possible, perhaps giving a few reminders and asking a few leading questions. For example, you might emphasize that they find the answer to each part separately first and keep a record of these partial answers. If needed, remind them that they know how to substitute values into an equation and that they have also seen parentheses and exponents before. By this time the students know the process and realize that they will be able to discuss the problem in the next step with their group so they should just do their best at this point. Keep the focus on the overall process, building on past experiences and Learning Projects where possible.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share the knowledge, but also to learn it more completely.

Small groups: *Compare your answer to others in the group and explain why and how you found your answer and why it is correct.*

Agree on the correct way to rewrite the equation, using the numbers instead of the variables.

Look at each part of the problem separately. What number did each of you find for them? Discuss your disagreements and resolve them.

What does 2C equal and how did you find it?

What steps are involved in finding $\frac{11(D+d)}{7}$*?*

What does $\frac{(D-d)^2}{4C}$ *ask you to do mathematically?*

Share how you used your calculator. Take notes describing situations when you entered numbers in a different order and achieved a different result. Explain when and why is entering numbers in a certain order important.

Agree on the correct answer and the step-by-step process to find that answer, both with and without the calculator and share with the whole class.

Did using the calculator make this problem easier or harder? Explain why you think so.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. *(A group or instructor led.)*

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

How did your previous learning about algebraic equations in the other Inquiry Activities help you, or your small group, to approach this problem?

How did breaking it down into smaller pieces (step by step) improve your chances of success?

In the last Inquiry Activity, you had to undo the operations that were shown in order to find the value of the unknown. Why didn't you have to use the undo process in this problem?

In this problem the unknown, L, was already isolated on its side of the equation so you did not have to remove any numbers (terms or factors) by undoing. You merely had to do the operations that were shown.

What other strategies helped you approach this problem more calmly, that you will need to remember to do future Practice Test problems?

Students should confirm in the resulting discussion that, although this problem looked overwhelming at first, calling on prior learning, breaking it down into smaller steps, replacing variables and rewriting the problem, all helped them face the problem with more confidence and less anxiety. They also had 5 optional multiple-choice answers from which they could choose, and the use of the calculator.

Was it important to be a mechanic or to understand car repair, and or to know about fan belts, to answer this question? Why was this context important?

The power of mathematics in this case was that we could evaluate the abstraction (the formula) without having to understand any mechanical ideas. Even though we could have solved the problem without the mechanic's context, it shows that there is a real world use of algebra, and that everyday trades and industries could require those skills of us.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

Perhaps students can research in science textbooks to find complex formulas that they can solve even though they do not understand the context.

Can you think of a standard formula you (or your small group) use in everyday situations? How and when is it applied?

For instance, in cooking, a student may find he/she always falls back on a standard formula for white sauce. She doubles it or triples it when needed. Or she may change certain parts to create a different result.

Do some research in science textbooks your instructor supplies to find complex formulas that you can solve even though you may not understand the context, or science, involved.

Note that the GED calculator has a Power of 2 key. How is it used? How is the shift key used to undo this operation, and find the square root of a number?

Practice squaring and finding square roots at this point. Try to emphasize the connection between the two by linking them: that is, because it is true that $7^2 = 49$, we know that $\sqrt{49} = 7$. Research may be done in the resource books if there is time, or the instructor can just supply practice.

How could you solve the problem without that key, if you were not comfortable using it?

Research your math resources for other algebraic equations using powers.

They were introduced to this in Inquiry Activity 3-3, but using the calculator was not discussed.

Once you and your small group are comfortable with the power of 2, or squaring, extend your knowledge to the power of 3, or cubing.

Decide how to use the parentheses keys in solving this problem. Does using them make it harder or easier for you? Explain.

You may want to challenge the students to try to enter the entire expression (the right-hand side of the equation) in the calculator at once, rather than just one part at a time.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

How have Learning Projects #3 and #4 built on each other's skills?

How can you use the directions for calculator use that accompanies the GED Math Test when actually taking the test?

How are you feeling toward algebra now? If you have continued anxiety or frustration, how can the instructor be helpful and give you more practice in areas in which you are not confident?

Has any explanation by a student, about how he/she approached or understood a problem, been clearer or meant more to you than the instructor's? Why and how?

This is a desired effect of group work. Often students will explain or see a problem in a way that relates better to the student who is stumbling, because they may be thinking in the same way or coming from similar experience.

Learning Project

Data Analysis — Mean and Median

Introduction

This Learning Project is another that confirms the emphasis on data analysis in the GED 2002. In these three Inquiry Activities, the common thread of data analysis is in the terms: median, mean, and average, although the word average is not used in any of the activities. The use of the formula page where these terms are defined is an especially interesting part of the exploration since these definitions are very complex to understand. A learner would have to bring knowledge of these definitions to the test rather than rely on help from the formulas page (Inquiry Activity 5-1).

Another interesting aspect of the problems in this Learning Project (Inquiry Activities 5-2 and 5-3) is that the average is a given and the learner has to find one of the numbers that will result in the given average. A connection to algebra equations is made in Step 5 in each of these Inquiry Activities.

Inquiry Activity 5-3 also presents an interesting average problem. As stated above, the average is given but the learner has to find two numbers that will result in the given average. What this forces the learner to do is to carefully review all of the multiple choice answers to find the correct combination of numbers. A very different, multiple step approach to averages.

The term mode is not presented in any of these problems and you may want to explore that concept in problems you find useful for that purpose. Another concept not discussed in this Practice Test is probability. You may want to go back to question 28 in the old Practice Test CC to discuss the idea and introduce the use of fractions.

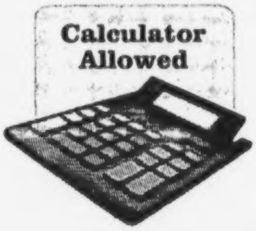
Learning Project Mean/Median

Inquiry Activity 5-1: Median

(Note: Italicized portions should be directed to the students)

1. Identifying the Problem (Item #2, PA) Calculator Use Allowed.

Read the question carefully, as you would if taking the actual test.



2. Ms. Nguyen is a real estate agent. One of her clients is considering buying a house in the Silver Lakes area, where 6 houses have recently sold for the following amounts: $160,000; $150,000: $185,000; $180, 000; $145,000; $190,000. What should Ms. Nguyen report as the median price of these houses?

1) $160,000
2) $170,000
3) $180,000
4) $190,000
5) Not enough information is given.

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list: median price.

What words and/or symbols are unfamiliar and what do you think they mean?

Here is a non-exclusive list of some of the words that may present problems with some learners: real estate agent.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question.

What is the question asking you to find?

The median price of 6 houses.

What information in the problem is relevant to finding the answer?

Need to find the definition of median. Prices of the 6 houses are relevant and are found in the problem.

What do you know about finding answers to this type of problem?

"Not sure I know what median is."

Review the Formulas page that accompanies the practice test (your instructor will make a copy available to you). Is there any help for this problem on that page?

The definition of median is there. It may not be of much help if the underlying concept is not known. Ask the learners to try to find the answer by puzzling through the definition. Learners will get a chance to find out more about median later in the Inquiry Activity.

3. Planning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions and strategies can be helpful.

What are you going to do with the 6 numbers given in the problem?

What does median mean and how does that definition relate to the problem?

Draw this problem.

Can drawing the problem help you solve it?

Solve the problem without using a calculator and indicate the steps you used.

Read the directions for the calculator accompanying the GED Math test (which you instructor will provide) and determine if anything there helps you to use the calculator to solve this problem.

Check for the reasonableness of your answer.

Choose one of the answer choices.

Once you've chosen an answer, be ready to defend the way you found it.

Note: At some point in "Performing Tasks," your assessment may reveal that there are certain knowledge gaps that may need attention, especially the definition of median and how it differs from average. However, allow each student to complete as much of the problem as possible, perhaps giving a few reminders and asking a few leading questions. Keep the focus on the overall process, building on past experiences and Learning Projects where possible.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

Small groups: *Compare your answer to others in the group and explain why and how you found your answer and why it is correct.*

How many different ways is there to solve this problem? Explain each.

Drawing the houses and putting them in order helps to visualize the problem.

Share how one can use a calculator to solve this problem, if at all.

Agree on the correct answer and the step-by-step process to find that answer, both with and without the calculator, and share with the whole class.

Did using the calculator make this problem easier or harder? Explain why you think so.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. (group activity or instructor led)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

Read the definition of Median on the "Measures of Central Tendency" on the Formulas page. How helpful is that definition to you? Explain.

Look up the definition of median in at least two different math textbooks and compare those definitions to the one found on the Formulas page of the Practice Test. Are there significant differences? Explain.

Develop your own definition of median that makes the most sense to you.

Do the texts suggest any particular way to solve median problems? Support your answer with references to the textbooks.

If the text suggests a way to solve median problems, use the method suggested by the text, and then compare it to the way the small groups decided to solve the problem. Are there any differences?

Did trying to draw the problem help to solve it? How?

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

What kind of data does median measure better than mean?

Median is usually more representative of the data when there is an extreme value on one end of the range but none on the other. See problem about employees on page 26 of *The GED Math Problem Solver: Reasoning Skills for Application* by Myrna Manly.

Make up at least 2 median problems, one with equal amount of numbers and one with an unequal amount of numbers.

Have you ever experienced the concept of median in your daily life? Explain.

Median is a kind of average. What other word for average do you know about?

Mode

Evaluating: Access what you learned and how you learned it.

In this last step, you get a chance to review both the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Have any of the previous Learning Projects help to solve this problem?

How important is understanding the exact definitions of math terms for the GED test? Explain.

How important is it to know what information is on the Formulas page of the Text?

Has any explanation by a student, about how he/she approached or understood a problem, been clearer or meant more to you than the instructor's? Why and how?

This is a desired effect of group work. Often students will explain or see a problem in a way that relates better to the student who is stumbling, because they may be thinking in the same way or coming from similar experience.

Learning Project Mean/Median

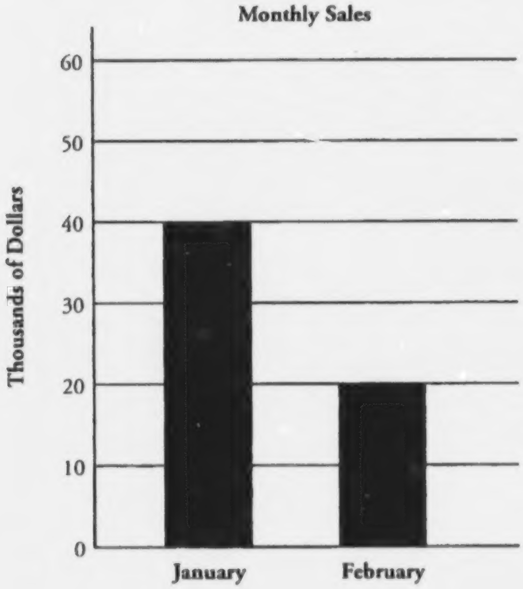
Inquiry Activity 5-2: Exploring Mean

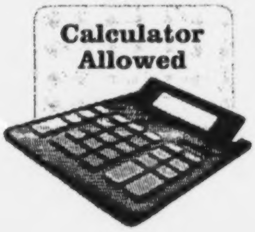
(Note: Italicized portions should be directed to the students)

1. Identifying the Problem (Item #1, PA) Calculator Use Allowed.

Read the question carefully, as you would if taking the actual test.

1. Kelly's goal is to average $25,000 per month in sales for the first three months of the year. Her sales for January and February are shown in the graph below.





To reach her goal, what is the minimum amount of sales Kelly must make in March?

1) $15,000
2) $24,960
3) $30,000
4) $35,000
5) $60,000.

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list: average, per month, minimum amount.

What words and/ore symbols are unfamiliar and what do you think they mean?

Here is a non-exclusive list of some of the words that may present problems with some learners: goal.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question.

What is the question asking you to find?

How much Kelly has to make in March to average $25,000 per month for a three-month period, when she has already made $40,000 in January and $20,000 in February?

What information in the problem is relevant to finding the answer?

The information from the graph: January made $40,000 and February made $20,000; the goal of averaging $25,000 per month.

Review the Formulas page that accompanies the practice test (your instructor will make a copy available to you). Is there any help for this problem on that page?

What do you know about finding answers to this type of problem?

To find an average, I know I have to add the number items and divide by the number of items (add three numbers and then divide by three). But here I know what the average number is; what is missing is one of the numbers I should add. This sounds like finding an unknown in the algebra problems I just did.

3. Planning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions and strategies can be helpful.

Use your experience with similar problems to make sense of this one. Can finding unknowns in the algebra Inquiry Activities help here? Explain.

Read the directions for the calculator accompanying the GED Math test (which your instructor will provide) and determine if anything there helps you to use the calculator to solve this problem.

Find the answer and record the steps you used.

Check for the reasonableness of your answer.

Choose one of the answer choices.

Once you've chosen an answer, be ready to defend the way you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

***Small groups:** Compare your answer to others in the group and explain why and how you found your answer and why it is correct. Write the answer in sentence form.*

Share how you used your calculator. Take notes describing situations when you entered numbers in a different order and achieved a different result. Explain whether it is important to enter numbers in a certain order.

Agree on the correct answer and the step-by-step process to find that answer, both with and without the calculator and share with the whole class.

Did using the calculator make this problem easier or harder? Explain why you think so.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. (group activity or instructor led)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

How did your previous learning about algebraic equations in the other Learning Projects help you, or your small group, to approach this problem? In other words, can you write the problem in terms of an equation? Show your equation.

$$\frac{40{,}000 + 20{,}000 + x}{3} = 25{,}000$$

$40{,}000 + 20{,}000 + x = 75{,}000$ (because averaging 25,000 a month for 3 months = 75,000 or by undoing the division on the left).

Learners may not originally use an equation, but it would helpful to think about the connection to equations.

Read the definition of mean on the "Measures of Central Tendency" on the Formulas page. How helpful is that definition to you to solve this problem? Explain.

Could you undo the operations in the equation you created to find the value of the unknown. Explain.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

In Small Groups: *Develop at least two problems similar to the one in this Inquiry Activity. In one problem, the unknown should be the average. In the other problem, the unknown should be one of figures that make up the average that is given.*

Each group should distribute its problems to the other groups for solution.

Discuss all the learner-created problems.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review both the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

How have Learning Projects #3 and #4 helped you to analyze this problem?

How are you feeling toward algebra now in light of this problem where algebra can help find an answer?

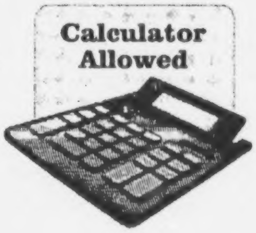
Learning Project Mean/Median

Inquiry Activity 5-3: Figuring Average

(Note: Italicized portions should be directed to the students)

1. Identifying the Problem (Item #13 , PA) Calculator Use Allowed.

Read the question carefully, as you would if taking the actual test.



13. The mean (average) weight of 5 boys is 160 pounds. If three of the boys weigh 152, 158, and 168 pounds respectively, which of the following could be the weights, in pounds, of the other two boys.

1) 165 and 150
2) 162 and 156
3) 160 and 162
4) 157 and 168
5) 155 and 172

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list: mean, average.

What words and/or symbols are unfamiliar and what do you think they mean?

Here is a non-exclusive list of some of the words that may present problems with some learners: new campsite, present location.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Re-read the question.

What is the question asking you to find?

The weight of two boys that, when combined with the weight of the three boys given in the problem, equal an average weight of 160 pounds.

What information in the problem is relevant to finding the answer?

All the information given in the problem is relevant.

What do you know about finding answers to this type of problem?

I know a little bit about finding averages.

Review the Formulas page that accompanies the practice test (your instructor will make a copy available to you). Is there any help for this problem on that page? Explain.

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions and strategies can be helpful.

Use your experience with similar problems to make sense of this one. How will you use your knowledge of finding averages in this problem?

Read the directions for the calculator accompanying the GED Math test (which your instructor will provide) and determine if anything there helps you to use the calculator to solve this problem.

Find the answer and record the steps you used.

Check for the reasonableness of your answer.

Choose one of the answer choices.

Once you've chosen an answer, be ready to defend the way you found it.

Note: At some point in "Performing Tasks," your assessment may reveal that certain knowledge gaps may need attention. However, allow each student to complete as much of the problem as possible, perhaps giving a few reminders and asking a few leading questions. For example, you might emphasize that they find the answer to parts of the problem separately first and keep a record of these partial answers. By this time the students know the process and realize that they will be able to discuss the problem in the next step with their group so should just do their best at this point. Keep the focus on the overall process, building on past experiences and Learning Projects where possible.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

***Small groups:** Compare your answer to others in the group and explain why and how you found your answer and why it is correct.*

Agree on the correct way to write an equation for this problem.

Look at each part of the problem separately. What number did each of you find for them? Discuss your disagreements and resolve them.

Share how you might use your calculator to solve this problem. Take notes describing situations when you entered numbers in a different order and achieved a different result. Explain when and why entering numbers in a certain order is important.

Agree on the correct answer and the step-by-step process to find that answer, both with and without the calculator and share with the whole class.

Did using the calculator make this problem easier or harder? Explain why you think so.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. (group activity or instructor led)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

Can you write the problem in terms of an equation? Show your equation.

$$\frac{152 + 158 + 168 + x + y}{5} = 160$$

152 + 158 + 168 + x + y = 800
x + y = 800 -152- 158 – 168
x + y = 332.
Now I have to look at the answer choices to see which pair equals 332.

How did your previous learning about algebraic equations in the other Learning Projects help you, or your small group, to approach this problem?

Read the definition of mean (average) on the "Measures of Central Tendency" on the Formula's page. How helpful is that definition to you to solve this problem? Explain.

How did breaking it down into smaller pieces (step by step) improve your chances of success?

Could you undo the operations in the equation you created to find the value of the unknown. Explain.

How did you use the answer choices that were provided to solve this problem?

How would you have answered this question if no answer choices were given?

What other strategies helped you approach this problem more calmly, that you will need to remember to do future Practice Test problems?

Students should confirm in the resulting discussion that although this problem looked overwhelming at first, calling on prior learning, breaking it down into smaller steps, undoing operations, all helped them face the problem with more confidence and less anxiety. Here the participant had to get the problem to a point where they could use the 5 optional multiple-choice answers to come up with a final answer.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

As a group, try to make up one average problem similar to this one that has two unknowns with five multiple-choice answers.

Record the steps you have to go through to make up your problem.

How can you learn about taking a test by developing test questions?

Each group should distribute its problems to the other groups for solution.

Discuss all the learner-created problems.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review both the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

How have Inquiry Activities 5-1 and 5-2 helped you to solve this problem?

How can you use the directions for calculator use that accompanies the GED Math Test when actually taking the test?

How can you learn to use the information on the Formulas page more effectively on the actual test?

- I could look at all of the information on the page and know what is there so when I come across a question that asks for mean or median, I know where to look to help me find the answer.

- Another strategy I could use is to go through all the formulas and definitions listed there and make sure I understand all the words used in the definitions.
- I could also rewrite some of definitions in my own words so that I can use the definitions on the formulas page as a way of triggering my own definition at test-taking time.
- I could use the formula's page as a review of what I know about math and to prepare me to take the math test.

Learning Project

Fractions, Proportions and Percents

Introduction

In this Learning Project, the mathematical emphasis is on the basic concepts regarding fractions, proportions and percents and their interrelationships. Fractions are dealt with in extension activities that support the concepts of proportions and percents, not as the main stimulus in these Inquiry Activities.

This Learning Project will have the learners go through each of the questions just as they are presented in the test, emphasizing, in addition to the math concepts considered, such test-taking skills as to how to use the multiple choice answers to help come up with an answer and not to use the answer grid. Of course, calculator use will be explored for those questions in which its use is permitted.

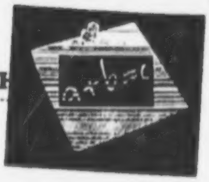
Inquiry Activity 6-1 is a proportion problem based on question 14 of the Official Practice Test (PA) for which calculator use is not allowed. This question has the traditional multiple-choice answers.

Inquiry Activity 6-2 is also a proportion problem and is based on question 18 of the Official Practice Test (PA) for which calculator is not allowed. This question requires the learner to place the answer on an answer grid.

Inquire Activity 6-3 is the final proportion problem in this Learning Project and is based on question 25 of the Official Practice Test (PA) for which calculator use is not allowed. While the first two proportion Inquiry Activities require the learner to answer to the proportion, this activity asks the learner for the set up of the problem, not the solution.

The next question has the traditional multiple-choice answers. Inquiry Activity 6-4 is based on question 10 of the Official Practice Test (PA) for which calculator use is allowed. This question also requires the learner to place the answer on an answer grid. Question 10 is a multi-step percent problem that also requires subtraction. This is a good problem to use to focus on the estimation process, providing that the learners first understand the concept of percents. Since the calculator can be used, it is also a good problem for the learner to discover how to use the calculator to do a percent problem. This also leads to the many different ways to use the calculator to solve the problem.

Inquiry Activity 6-5 is based on question 12 of the PA version of the 2002 GED Practice Test for which a calculator is allowed. This question has the traditional multiple-choice answers, which can guide the learner in the estimation process (eliminate choices 1 and 2). How one tips in restaurants can help with this problem since you can figure in your head what 10% of 650 is and then halve that figure. Since a calculator can be used, the learners can again explore the many ways to use the calculator to solve a percent problem. Inquiry Activity 6-6 is based on question 23 of the PA version of the 2002 Practice Test for which a calculator is not allowed to be used. This question has the traditional multiple-choice answers, one of which is "not enough information is given." This is one of the few chances to discuss this answer choice in the PA version of the Practice test.

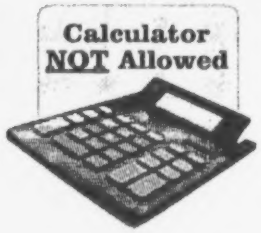


Inquiry Activity 6-1: Setting up and Solving a Proportion

(Note: The italicized portion is directed to the learners.)

1. Identifying the Problem (Item # 14, PA) Calculator Not Allowed.

Read the question carefully, as you would if taking the actual test.



14. The scale on a hiker's map states that 1 inch = 2000 feet. Anna wants to know how far it is to her next campsite. On the map, the next campsite is 5 inches from her present location. What is the actual distance, in feet, between Anna's present location and her next campsite?

(1) 5
(2) 400
(3) 600
(4) 5,000
(5) 10,000

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list: scale, actual distance, 1 inch = 2000 feet.

What words and/or symbols are unfamiliar and what do you think they mean?

Here is a non-exclusive list of some of the words that may present problems with some learners: new campsite, present location.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question. What is the question really asking?

Which information in the problem is relevant to what you need to find?

What do I know about this kind of problem?

Could be using a map to take a road trip, reading scales on a map, camping experience, etc.

What does the problem really look like — sketch a picture of what's going on in the problem.

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even it you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions and strategies can be helpful as strategies to use solve test questions.

Use your experience with similar problems to make sense of this one.

What is the problem asking you to do in terms of mathematics…bringing together, separating, or comparing?

Restate the question (or situation) using fewer words.

Estimate an answer – tolerate some fuzziness, but be aware of the steps you took to make the estimate, even if you guessed!

Eliminate unreasonable multiple-choice answers.

Find the answer.

Compare your answer to the estimate.

Is the answer reasonable?

Be ready to defend your answer (whether you worked individually or with someone else) and the way you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

Small groups: *Compare your answers to others in the group and explain why and how you found it and why you think it is correct.*

Agree on the correct answer and the step-by-step process used to find that answer.

Do some research in the math texts that are available and look up unfamiliar vocabulary if necessary so that everyone can agree.

Write the procedure that you used as a sequence of steps, that is, Step 1, Step 2, etc.

Write the procedure as a mathematical expression.

Prepare a presentation of your answers to all these questions, including the estimation process members of your group used.

Whole Class: *Report to the class your determinations of the steps you decided on to answer this question, the estimation process used, as well as the mathematical expression that summarizes them.*

At the completion of all the group presentations, the class should discuss all of the different ways to solve the problem, or if everyone used the same method, what other methods could be used.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. (group activity or instructor led)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

What reading and thinking skills did you use to solve this item?

Did you solve this problem without knowing or using the proportion formula? Explain.

How will reading and thinking skills help you during the test? In future learning?

If you have had previous experience with using maps or going camping, how did that experience help you with this problem?

Extending: Extend what you learned to new situations. (group activity or instructor led)

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe making new connections to other information.

This kind of problem is known mathematically as proportion problem. Find what the textbook says about how to set up the solution to this problem and solve it. Be prepared to present the textbook method.

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Compare the method you used to solve this problem and the textbook explanation. Which do you prefer?

Learners may say that their method is better and that the textbook explanation is too academic. Have them be sure the their method works for other kinds of proportion problems.

How is a proportion problem similar to or different from the algebra used in both Algebra Learning Projects you previously explored?

The textbook formula does use an equation with an unknown.

Have you ever used your road map to calculate the distance of a trip or the estimated time of arrival? Explain how you did that.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review both the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

What strengths of mine were apparent during this Inquiry Activity?

How can you use those strengths to learn math problems with which you are not familiar?

What weaknesses of mine were exposed and how can I overcome them?

Is the format of the Inquiry Activity helpful to you in learning math? Explain.

Is the process you go through (the first three steps) in the Inquiry Activities helpful to you in taking tests? Explain.

Your instructor will lead a class discussion of all of the questions and issues discussed in your groups in this Extending, Extending, and Evaluating section.

Each group should be prepared to present and support their answers. They should also be flexible of mind to determine if another group may be presenting new or useful information or computation techniques that they can use.

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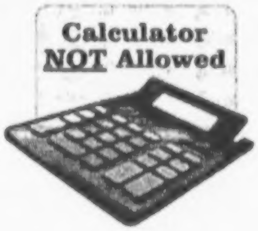
Learning Project Fractions, Proportions and Percents

Inquiry Activity 6-2:
Setting up and Solving Another Proportion

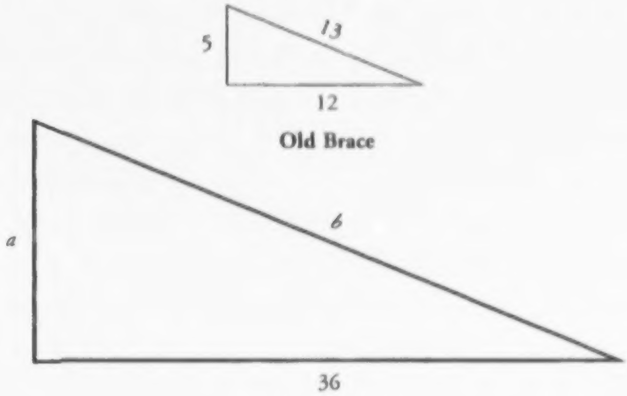
(Note: The italicized portion is directed to the learners.)

1. **Identifying the Problem (Item # 18, PA) Calculator not allowed. Problem must be answered on answer grid.**

Read the question carefully, as you would if taking the actual test.



18. A carpenter is making a larger triangular brace similar to the one shown below.



Old Brace

New Brace

The base of the new brace is 36 inches. What is the length, in inches, of side b if the triangles are similar?

PLEASE DO NOT WRITE IN THIS TEST BOOKLET.
Mark your answer in the circles in the grid on your answer sheet.

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list: Triangle, triangles being similar, length, inches, side b,

What words and/or symbols are unfamiliar and what do you think they mean?

Here is a non-exclusive list of some of the words that may present problems with some learners: brace, triangular brace, base.

2. **Becoming Familiar with the Problem**

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question. What is the question really asking?

Which information in the problem is relevant to what you need to find?

What do I know about this?

Any experience with building or fixing up might help understand the context.

What does the problem really look like? — Sketch a picture of what's going on in the problem.

3. Planning and Performing Tasks

Try to answer the test question any way you can, even it you have to guess, but try to be aware of the reasoning and operations that you are using. The following directions and questions can be helpful.

Use your experience with similar problems to make sense of this one.

What is the problem asking you to do in terms of mathematics…bringing together, separating, or comparing?

Comparing

In your own words, determine what to look for in the facts of this problem.

Restate the question (or situation) using fewer words.

Estimate an answer – tolerate some fuzziness, but be aware of the steps you took to make the estimate, even if you guessed!

Eliminate unreasonable multiple-choice answers.

Find the answer.

Compare your answer to the estimate.

Is the answer reasonable?

Be ready to defend your answer (whether you worked individually or with someone else) and the way you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

***Small groups**: Compare your answers to others in the group and explain why and how you found it and why you think it is correct.*

Agree on the correct answer and the step-by-step process used to find that answer.

Do some research in the math texts that are available and look up unfamiliar vocabulary if necessary so that everyone can agree.

Write the procedure that you used as a sequence of steps, that is, Step 1, Step 2, etc.

Write the procedure as a mathematical expression and compare it to the steps you used above. Explain similarities and differences.

***Whole Class:** Report to the class your determinations of the steps you decided on to answer this question, the estimation process used, as well as the mathematical expression that summarizes them.*

At the completion of all the group presentations, the class should discuss all of the different ways to solve the problem, or if everyone used the same method, what other methods could be used.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. (group activity or instructor led)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

What reading and thinking skills did you use in this item?

How will reading and thinking skills help you during the test? In future learning?

If you have had previous experience with building, how did that experience help you with this problem?

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

How did you use the information you learned from Activity 6-1 to solve this problem? Explain your thinking and your steps.

How were the problems different?

If you have not already done so, set up the problem this Inquiry Activity as a proportion formula.

How could you solve this problem without setting up the proportion formula?

What connections did you find between this problems and other Learning Projects or math that you have studied? Explain.

How would you use the proportions formula to change a recipe to serve more people? How would you change a recipe using your method?

In what other situations than recipes might you use proportions around the house?

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review both the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Does knowing the formal proportion procedure help you to solve proportion problems? Explain.

What will you do to make sure that you have placed the numbers in the proportion problem in the proper place in the proportion formula?

Learning Project Fractions, Proportions and Percents

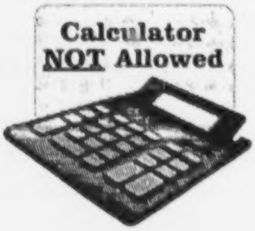
Inquiry Activity 6-3: Setting up a Proportion

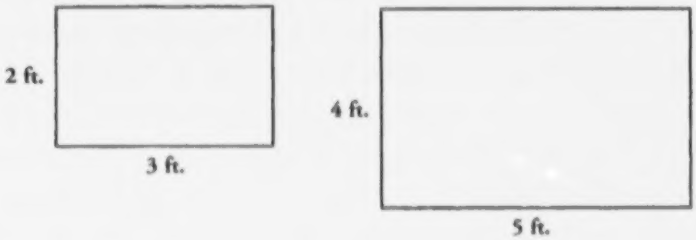
(Note: The italicized portion is directed to the learners.)

1. **Identifying the Problem: (Item # 25, PA) Calculator not allowed.**

Read the question carefully, as you would if taking the actual test.

25. The public transportation system in Centra City charges $90 for a 2-ft. by 3-ft. rectangular advertising space in its buses.





If the price (x) of an ad is proportional to its AREA, which of the following expressions correctly determines the price (x) for a 4-ft. by 5-ft. advertisement?

(1) $\frac{5}{9} = \frac{90}{x}$

(2) $\frac{6}{20} = \frac{90}{x}$

(3) $\frac{6}{x} = \frac{20}{90}$

(4) $\frac{10}{18} = \frac{90}{x}$

(5) $\frac{10}{x} = \frac{18}{90}$

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list: price proportional to area.

What words and/or symbols are unfamiliar and what do you think they mean?

Here is a non-exclusive list of some of the words that may present problems with some learners: rectangular advertising space.

2. **Becoming Familiar with the Problem:**

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question. What is the question really asking?

Which information in the problem is relevant to what you need to find?

What do I know about this?

Any experience with public transportation and the advertising there might help in understanding the context but not the math. Research on Proportion formula in previous Inquiry Activities in this Learning Project helps.

The problem has two sketches. How does that help you with this problem?

Can the Mathematics Formula page found in the Official Practice Test booklet help?

What math functions do you think need to be performed here, if any? (Remember, just list them or think about them; don't do them yet!)

3. Planning and Performing Tasks:

Try to answer the test question any way you can, even it you have to guess, but try to be aware of the reasoning and operations that you are using. The following directions and questions can be helpful.

Use your experience with similar problems to make sense of this one.

What is the problem asking you to do in terms of mathematics… bringing together, separating, or comparing?
Proportion is a comparing process.

In your own words, determine what to look for in the facts of this problem.

Restate the question (or situation) using fewer words.

Eliminate unreasonable multiple-choice answers.

Find the answer.

Is the answer reasonable?

Be ready to defend your answer (whether you worked individually or with someone else) and the way you found it.

4. Sharing with Others:

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge but to learn it more completely.

***Small groups**: Compare your answers to others in the group and explain why and how you found it and why you think it is correct.*

Agree on the correct answer and the step-by-step process used to find that answer.

Give an explanation as to why each of the other answer choices is incorrect.

Do some research in the math texts to find support for the proportion formula that your group decided was the correct answer. Don't forget to cite the text name and page number that you used.

***Whole Class:** Report to the class your determinations of the steps you decided on to answer this question, the estimation process used, as well why the incorrect answer choices are wrong.*

At the completion of all the group presentations, the class should review how this problem shows how the set up of the proportion problem is the most critical factor when solving it.

5. Reflecting, Extending and Evaluating:

Reflecting: Think about what you learned. (Group activity or instructor lead)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

Give an explanation of why the following are also a correct answer to this problem:

$$\frac{20}{6} = \frac{x}{90}$$

$$\frac{6}{90} = \frac{20}{x}$$

$$\frac{90}{6} = \frac{x}{20}$$

Solve the problem, find out the value of x.

Given there are four ways to set up this proportion problem, which way do you prefer to set up the formula? Explain

Support the learner's preferences.

Sum up your understanding of how to set up a proportion problem?

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe making new connections to other information.

How is this problem different from the other two Inquiry Activities related to proportion?

How is this problem the same?

Are there other Learning Projects that you have explored that are connected to this one in some way? Explain.

How similar is the math in proportions to an algebraic formula? Explain.

Can an understanding of fractions and equivalent fractions help with understanding a proportion problem? Explain.

Knowing that $\frac{4}{5}$ is equivalent to $\frac{8}{10}$ does help with a conceptual understanding of proportions and the proportions formula.

Find out about word analogies from non-math texts and determine how analogies and proportion problems are similar and how they are different.

Analogies have a kind of rigorous (logical) setup as does the formal proportion formula. It is important to set up the analogy "kitten is to cat as pup is to dog" as it is to set up a proportion problem in math.

You or you group make up at least one proportion problem similar to the one explored here (where you have to find the correct formula that expresses the problem). Pass your problems to other groups to solve and discuss as a class, including how to solve for the unknown.

What are other situations in which the concept of proportions can be used and how would you use the proportion formula in those other situations?

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review both the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions, only your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Has an understanding of proportions helped you to understand algebra any better? Explain.

Has an understanding of proportions helped you to understand equivalent fractions any better? Explain.

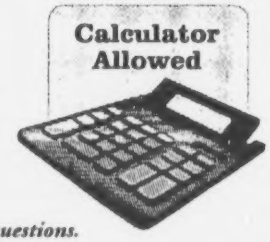
Learning Project Fractions, Proportions and Percents

Inquiry Activity 6-4:
Multi-step Problems and Percents

(Note: Italicized portions should be directed to learners.)

1. Identifying the Problem: (Item # 10, PA) Calculator allowed

Read the question carefully, as you would if taking the actual test.



10. Juanita had her car windshield replaced at a cost of $250. After a $50 deductible is applied (i.e., Juanita pays the first $50), her insurance company will pay 80 percent of the remaining balance. In dollars, how much will the company pay?

PLEASE DO NOT WRITE IN THIS TEST BOOKLET.

Mark your answer in the circles in the grid on your answer sheet.

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

The following, among others, are possibilities: deductible, remaining balance.

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question. What is the question really asking?

Which information in the problem is relevant to what you need to find?

What do you know about insurance policies with a deductible?

What will the answer look like; will it be a percent or dollars?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even it you have to guess, but try to be aware of the reasoning and operations that you are using. The following directions and questions can be helpful.

Use your experience with similar problems to make sense of this one.

Restate the problem using fewer words.

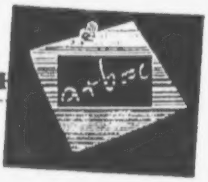
What math operations are involved with deductibles?

Break the problem down into parts.

Estimate an answer and be aware of the steps you used to estimate.

Do the work to find an answer.

Can the calculator help you find an answer?



Is the answer reasonable?

Compare your answer to your estimation.

Mark your answer on the answer grid.

Be ready to defend your answer (whether you worked individually or with someone else) and the way you found it.

4. Sharing with Others: Class Discussion of Results

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

***Small groups**: Compare your answer to others in the group and explain why and how you found it and why you think it is correct.*

Agree on how the problem can be broken down into smaller, more manageable steps.

Agree on the correct answer and the step-by-step process used to find that answer.

Most will subtract $50 from 250 first so the second step will be to find 80% of 200. It is on the second step where you will see many different procedures.

Explain how the calculator can help in the solution of the problem.

Do some research in the math texts and find at least two different examples of how to do this kind of a percent problem. Be sure to cite the text name and page number that you used.

***Whole Class:** Report to the class your determinations of the steps you decided on to answer this question and the estimation process used.*

At the completion of all the group presentations, the class should review the text book explanations of how to perform this kind of percentage problem.

They will probably find both the proportion method and the equation method using either fractions or decimals. It is likely that neither of these will be the way that they first found the answer. Encourage them to compare.

Discuss the different ways the correct answer can be correctly entered into the answer grid.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned.

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

How many different ways were presented to solve this problem? What were they?

How do most of the procedures used show an understanding of percents?

This is a good opportunity to examine the different thought processes used to solve this problem– some may have thought that 10% of 200 is 20 and then multiplied that by 8 to get 160. Others may have thought that 80% of 100 is 80 and doubling that is 160. Some may have used the analogy idea and puzzled it out. Some may have used the calculator with the percent key. Others will have just multiplied 80 by 200, realized the answer was too large, and then moved the decimal point. It is critical at this point for the teacher to reconcile all of these procedures, pointing out that most of them show that they do understand percents in some way. The message should be the underlying idea of percents that all of them show, not that there is one or even two ways to do this problem.

How did breaking up the problem into smaller steps help you to come up with an answer?

How did you know what math to perform at each of the different steps?

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

There are many extension questions that follow. You can pick the ones that your class may be ready for and eliminate others.

Connect this problem to what you learned in other Learning Projects:

Explain how the proportions that you studied in Inquiry Activities 6-1 through 6-3 are relevant to percent problems?

How is this math situation similar to the questions in Inquiry Activities 2-1 and 2-2 in the Rates Learning Project?

Be prepared to reinforce learner's insights into connections to other math.

How is it different?

Explain how a percent problem can be solved using the algebra ideas you learned in both Algebra Learning Projects?

Can use a template approach. Rate x Base = amount. Have to solve for whichever is the unknown.

Solve other problems in ways that may not be textbook related. Your instructor will break you up into groups. Each group is to perform the following tasks:

These questions about this particular item should have already been discussed in the Reflect stage. Now they should be looking at other problems and making decisions as to what method they like best for other problems that may be more or less complicated. Find some examples that you think would be good.

Come up with as many different ways as possible to solve this other problem. Make sure that the group shows all the steps in these other solutions.

Compare all the approaches and determine which is the most efficient way to solve the problem.

Compare all the approaches and determine which way you would use to solve a similar problem on the GED test.

Expand on what you know about the situation indicated in the problem (insurance, deductibles, and percent of coverage) and also to transfer the math learned to other situations in which the math may be used.

Discuss other insurance situations that are similar to the one presented in the problem.

Discuss how to use the math used in this problem in those other situations.

List other situations (not insurance) in which the math can be used and determine how to use the math in those other situations.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review both the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

What strengths of mine were apparent during this Inquiry Activity on percents?

What weaknesses of were exposed and how can I overcome them?

Which questions or strategies in the first three steps were most helpful to you? Explain.

Does having test-taking strategies to use help reduce math anxiety? Explain.

Learning Project Fractions, Proportions and Percents

Inquiry Activity 6-5:
More Multi-step Problems and Percents

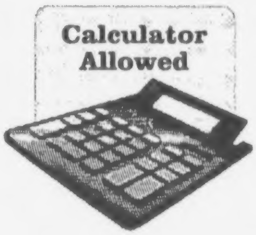
(Note: The italicized portion is directed to the learners.)

1. Identifying the Problem (Item # 12, PA) Calculator allowed

Read the question carefully, as you would if taking the actual test.

12. Susan left $650 in a savings account for one year. At the end of that time she received an interest credit of 5%. Then she withdrew all of her money and had to pay a service charge of $1.75. How much money did she have after paying the service charge?

(1) $ 648.25
(2) $ 653.25
(3) $ 680.75
(4) $ 682.50
(5) $ 684.25



Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

The following, among others, are possibilities: savings account, interest credit, service charge, withdrew.

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question. What is the problem really asking?

Which information in the problem is relevant to what you need to find?

What do you know about savings accounts, interest, and service charges?

How many math steps might there be to solve this problem?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even it you have to guess, but try to be aware of the reasoning and operations that you are using. The following directions and questions can be helpful.

Use your experience with similar problems to make sense of this one.

Restate the problem using fewer words.

What math operations are involved with interest?

Break the problem down into parts.

In this problem, do you deduct the service charge before or after you calculate interest gained?

Estimate an answer and be aware of the steps you used to estimate.

Eliminate unreasonable answer choices.

Do the work to find an answer.

Can the calculator help you find an answer?

Is the answer reasonable?

Compare your answer to your estimation.

Choose an answer.

Be ready to defend your answer (whether you worked individually or with someone else) and the way you found it.

4. Sharing with Others: Class Discussion of Results

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

***Small groups**: Compare your answer to others in the group and explain why and how you found it and why you think it is correct.*

Agree on how the problem can be broken down into smaller, more manageable steps.

Agree on the correct answer and the step-by-step process used to find that answer.

Explain how the calculator can help in the solution of the problem.

Do some research in the math texts and find at least two different examples of how to do this kind of a percent problem. Compare this to the research you did on percents in the Inquiry Activity 6-4. Remember to cite the text name and page number that you used.

***Whole Class:** Report to the class your determinations of the steps you decided on to answer this question, the estimation process used, why the incorrect answer choices are wrong, and any other subject brought up during the small group discussion.*

At the completion of all the group presentations, the class should review the textbook explanations of how to perform this kind of percentage problem.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned.

> ***Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.***
>
> *What were some of the reading skills you used while going through step 1, Identifying the Problem?*
>
> *What were some of the thinking skills you used while breaking the problems into parts? (In other words, how did you go about thinking about the problem? List all the steps.)*
>
> *What new insights about math did you gain from thinking through this multi-step problem?*

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know about and maybe making new connections to other information.

Did you think about the previous Inquiry Activity when you were doing this one?

Did you use some of the information or concepts learned there as prior knowledge for this Inquiry Activity?

What in this Inquiry Activity is similar to and what is different from the previous Inquiry Activity?

> You as instructor should build more questions into this section since you may change the order in which the Learning Projects are presented. The following are just suggestions. Feel free to substitute specific references to Learning Projects not mentioned here.

Solve this problem in ways that may not be textbook related. Your instructor will break you up into groups. Each group is to perform the following tasks:

> *Come up with as many different ways as possible to solve this Practice Test Problem. Make sure that the group shows all the steps in these other solutions.*
>
> *Research what the textbook says is the way to solve the problem. Note the textbook and page number where this information is found.*
>
> *Compare all the approaches and determine which is the most efficient way to solve the problem.*
>
> *Compare all the approaches and determine which is the most efficient way to solve a similar problem on the GED Test.*

Expand on what you know about the situation indicated in the problem (savings accounts, and interest) and also to transfer the math learned to other situations in which the math may be used.

Discuss other savings account situations that are similar to the one presented in the problem.

Discuss how to use the math used in this problem in those other situations. (For instance what happens if Susan only kept the money in the account for 6 months?)

List other situations (not savings accounts) in which the math can be used and determine how to use the math in those other situations.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review both the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

> *What do you now know about proportions and percents that you did not know before you started this Learning Project.*
>
> *What more would you like to learn? (Ask the facilitator for practice items.)*
>
> *What test-taking strategies do you think you will use when taking the GED test? Explain.*
>
> *How have the math reading and thinking skills used in these Learning Projects prepared you for taking the GED test. Explain.*

Learning Project Fractions, Proportions and Percents

Inquiry Activity 6-6: More Multi-step Problems and Percents

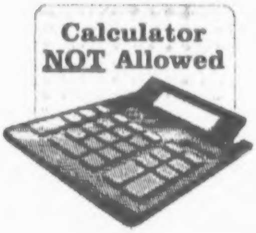
(Note: The italicized portion is directed to the learners.)

1. Identifying the Problem (Item # 23, PA) Calculator not allowed.

Read the question carefully, as you would if taking the actual test.

23. Julio invested a sum of money at 6% interest. Krista invested $200 less than Julio, but her bank paid her 9% interest. After one year, what was the DIFFERENCE between the amount of interest Krista had earned and the amount of interest Julio had earned?

(1) $ 6.00
(2) $ 12.00
(3) $ 18.00
(4) $200.00
(5) Not enough information is given



Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

The following, among others, are possibilities: invested, difference.

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question. What is the problem really asking?

Which information in the problem is relevant to what you need to find?

What do you know about savings accounts and interest?

How many math steps might there be to solve this problem?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even it you have to guess, but be aware of the reasoning and operations that you are using. The following directions and questions can be helpful.

Use your experience with similar problems to make sense of this one.

Restate the problem using fewer words.

What math operations are involved with interest?

Break the problem down into parts.

Estimate an answer and be aware of the steps you used to estimate.

Do the work to find an answer.

Review the answer choices.

Eliminate unreasonable answer choices.

Choose an answer.

Be ready to defend your answer (whether you worked individually or with someone else) and the way you found it.

4. Sharing with Others: Class Discussion of Results

Telling other people what you know helps you to understand the material better. Take this opportunity not only to share your knowledge, but also to learn it more completely.

Small groups: *Compare your answer to others in the group and explain why and how you found it and why you think it is correct.*

Agree on how the problem can be broken down into smaller, more manageable steps.

Discuss how you proceed in answering a test question when one of the answer choices "not enough information is given" and agree on a procedure.

Determine how you will use the multiple-choice answer "Not enough information given" in your estimation process and then estimate the answer before doing any computing. Be prepared to list and support the steps used in the estimation process.

Whole Class: *Report to the class how you decided on the steps to answer this question, how you handled the estimation process, how you handled the answer choice "Not enough information given," and any other subject brought up during the small group discussion.*

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned.

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

What new insights about multi-step math problems have you gained from all the Inquiry Activities in this Learning Project on Proportions and Percents?

What test-taking strategy do you use when one of your answer choices is "Not enough information given?

Explain how you use thinking, reading, and computational skills in problems when one of the answer choices is "Not enough information given."

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know about and maybe make new connections to other information.

What information, not supplied, do you need to be able to come up with an answer in dollars?

Supply a number for the amount of money that Julio invested and solve the problem.

Find in the textbooks the section where it is explained how to solve this kind of percent problem (if all the numbers had been originally supplied) and discuss the explanation.

Make up similar problems using percents and pass them to other class members to solve.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review both the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

If you had math anxiety before starting the first Learning Project, how do you now feel about math?

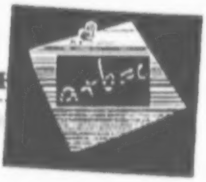
In Step 1, Identifying the Problem, the following statement is made:
"Here are some problem clarification questions you may want to consider when reading test questions." Did those clarification questions help you to solve the problems?

In Step 2, Becoming Familiar with the Problem, you are asked to take note of questions you might use when taking a test. What questions in that section did you find the most helpful?

The least helpful?

What questions in Step 3, Planning and Performing Tasks, helped you to become aware of the reasoning and operations to be used to solve or guess at the solution to GED math problems? Explain.

In the introduction to Step 4, Sharing, the following statement is made: "Telling other people what you know helps you to understand the material better." Did telling others how you did a math problem help you to understand better? Explain.



Learning Project

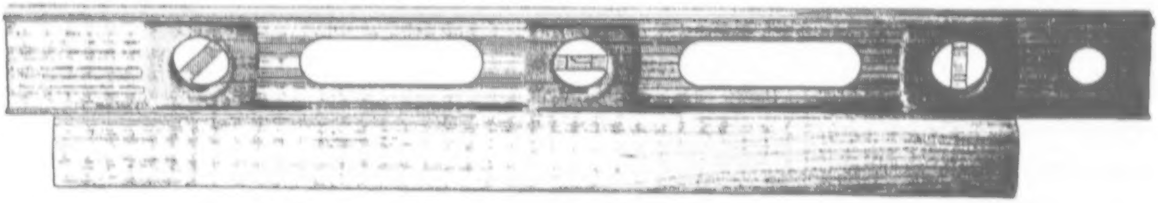
The Coordinate Plane, Intercepts and Slopes

Introduction

The new version of the mathematics test in GED 2002 has a greater emphasis on data and statistics than the previous tests, so it contains more graphs than the earlier version. This Learning Project focuses on the features of graphs that provide particular interest when interpreting their stories. Inquiry Activity 7-1 (item #22) uses the coordinate grid answer format. We use it to introduce the ordered pair notation (x,y) for points on a plane, as well as to discuss circles and negative numbers.

The next three Inquiry Activities (7-2 to 7-4) all refer to the same stimulus, a graph showing the line of best fit for a group of data points. The first two items involve tasks that the students have already studied in the first Learning Project on informational graphs: locating a precise point and interpolating to estimate the value of the y-intercept. The last activity (7-4) is a critical one in that it connects the ideas of rate of change and slope of a line. Students are asked to find the slope by inspecting the graph, but are later introduced to the formula for the slope that is included on the formulas page. Students look at the overall story a graph is telling by making generalizations about the rate of change that is indicated by straight lines vs. curved lines and positive slopes vs. negative slopes. Finally, you can connect algebra to geometry by analyzing an equation from a previous activity looking for its slope and y-intercept.

While the topics involved in this project can be much more sophisticated than in other projects, answering the questions that are asked about them does not require a rigorous understanding. Emphasize the big picture rather than the details, the reasoning rather than the procedures.

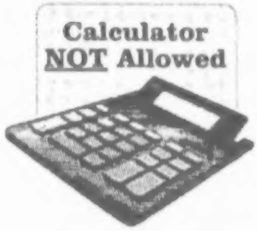


Inquiry Activity 7-1: The Coordinate Plane

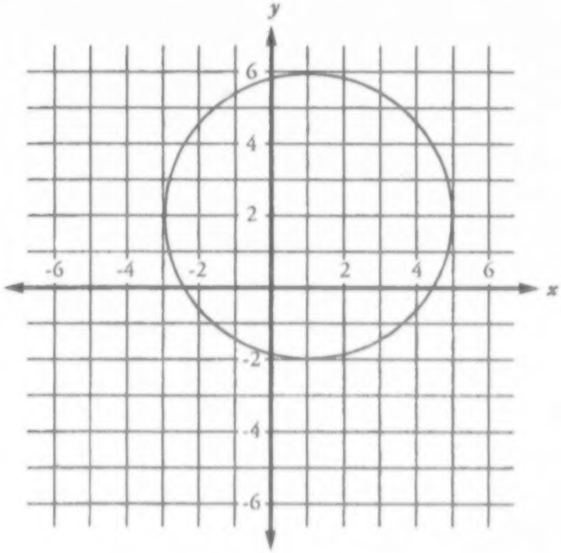
(Note: Italicized portions should be directed to students.)

1. Identifying the Problem (Item #22, PA) Calculator not allowed.

Read the question carefully, as you would if taking the actual test.



22. The graph of a circle is shown on the grid below.



What point is the location of the center of the circle?

Do not mark on the graph above.

Mark your answer on the coordinate plane grid on your answer sheet. (Which your instructor will provide.)

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list: graph, circle, grid, center of circle.

What words and/or symbols are unfamiliar and what do you think they mean?

Cannot know what words the learner will choose.

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2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question.

What are you being asked to find?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess. Try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

In your own words, determine what to look for in the graph.

The center must be equally distant from all points on the circle.

Find the answer and then find and bubble in the correct point on the coordinate plane grid.

Check your answer back in the original graph.

Be ready to explain how you chose your answer.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain how you decided that it was the center of the circle and how you know that the correct point is bubbled in.*

You will not be allowed to make any marks on the test itself. Agree on a reliable method to ensure that the point you have bubbled in on the answer grid is the one you decided on in the coordinate plane.

You may need an overhead transparency of the graphic in the item as well as one of the coordinate grid so that students can refer to specific points.

Whole class: *Report your group's answer to this question as well as the procedure that you recommend to check that the coordinate grid is bubbled in correctly.*

The traditional (x,y) coordinate method will be discussed in a later phase of this inquiry. At this point, you should praise their creativity and problem-solving abilities without referring to a 'better' way.

Take notes on any different ways that others used to find the answer.

5. Reflecting, Extending and Evaluating.

We recommend that you use this stimulus again during the geometry Learning Project when you are discussing area and perimeter. For now, focus on the characteristics of a circle, the coordinate system, and adding and subtracting with negatives. For some groups, each of these could be an entire lesson itself.

Reflecting: Think about what you learned. (A group activity or instructor led.)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

The discussion will take off from wherever the students left it in the previous step. If they had difficulties recognizing where the center of the circle should be in the graph, that geometric concept should be the first order of business. Encourage them to use the vocabulary of circles: radius, diameter, and circumference.

Look up the mathematical definition of the center of a circle in one of your math books. Show that the answer to this problem satisfies the requirement of the definition.

The four points that are on the vertical and horizontal diameters provide easy places to count the number of squares. To show that *all* points on the circle are equidistant from the center, they might mark off the length of the radius on a sheet of paper (or use a ruler) and rotate it around the center.

How many units are there in the radius of this circle? The diameter?

Here the units we are referring to are the spaces between the lines on the graph: 4 for the radius and 8 for the diameter.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

The second idea that was important in answering this question was the marking of the correct point in the coordinate grid. Since we know that there will be two questions on every GED test that use this grid as an answer format, the students should master the concept of the structure of the coordinate graph itself - the axes, the origin, the (x,y)coordinates of points, and the negative numbers that are involved.

Compare the underlying grid in this problem to the one from problem #15 (Inquiry Activity 1-4). How does this one differ? How are they alike?

There are differences in the way that the axes are marked, but the major focus here should be that the grid for this problem has four quadrants. It includes negative numbers on both the x- and y-axes. The grid for problem 15 is similar to the first quadrant of this one where both the variables are positive.

There is a standard method of referring to the points on the coordinate plane. Look up the coordinate system in your math books to find the ordered pair, (x,y), notation for points on the graph. Compare the method you used in this problem to the standard one.

The chances are that the methods that they created above will be somewhat similar to the standard way of noting where a point is. Starting at the origin, determine how far to the left or right the point is located. That number, the x-value, always comes first in the ordered pair. The second number tells how far up or down from the origin the point is located.

Write the (x,y) coordinates of the center of the circle in this problem. Also write the coordinates of the two points on the circle which are directly above and below the center and the two points on the circle which are directly across from the center on the left and the right.

Center (1,2), Above (1,6), Below (1,-2), Left (-3,2), Right (5,2)

Use the exercises in your math book to practice point-plotting and point-naming.

This problem offers the opportunity to bring up the idea of adding and subtracting with positive and negative numbers on a number line. Rather than introducing any rules, encourage the students to make sense of the relationship by counting the units on the graph.

The y-value of the lowest point on the circle is –2, while the y-value of the highest point is 6. What is the distance between the two points? Complete the following equations:

a) -2 + ___ = 6
b) 6 – ___ = -2
c) 6 – (-2) = ___

If the students have difficulty here, use the overhead and indicate the two points on the graph and ask the following questions. For a), What do you have to add (move up) to –2 to get to 6? For b), What do you have to subtract (move down) from 6 to get to –2? For c), What is the distance (or difference) between 6 and –2?

Write three similar equations using the x-values, -3 and 5, of the points to the left and right of the circle and the distance between them.

In your groups, discuss some situations in your life where negative numbers are involved. Write equations involving addition (or subtraction) of these numbers that describe a common situation.

For example, they could use the example of a thermometer where the temperature at 5 pm was 10 degrees and the night-time low was –8 degrees. To answer the question, "How many degrees did the temperature fall?" they could write, 10 - __ = -8, or 10 – (-8) = ___

Yardage gains and losses in football also provide an interesting context for some. Elevation above and below sea level, river heights above and below flood level, stories of a building above and below ground level are others.

There will be two questions on the GED math test whose answers will be recorded on the coordinate grid. Make up that kind of a question and ask the other groups to answer it.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Which idea from this activity - the characteristics of a circle, the coordinate system, or adding and subtracting with negative numbers – was the most difficult for you? Which was the easiest? Explain.

Ask for practice exercises if you think you need them.

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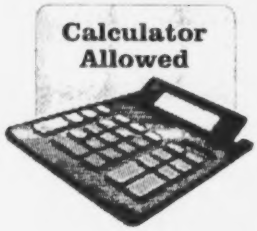
Learning Project The Coordinate Plane, Intercepts and Slopes

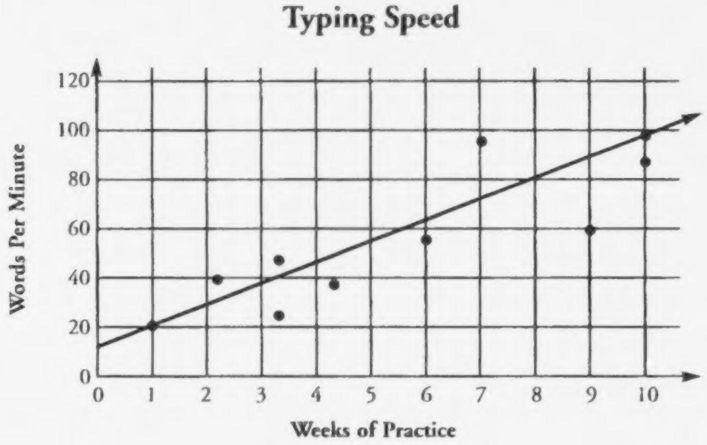
Inquiry Activity 7-2:
A Line of Best Fit/Locating a Point

(Note: Italicized portions should be directed to students.)



1. **Identifying the Problem (Item #4, PA) Calculator allowed.**

   Read the question carefully, as you would if taking the actual test.



Partners for Excellence offers its employees training classes to improve their typing skills. The graph above shows the typing speed results of 10 employees, as well as the line of best fit showing typing speed based on these results. The line of best fit can be used to make predictions for future employees who wish to take the classes.

4. What does the line of best fit predict the typing speed, in words per minute, will be for an employee who attends eight weeks of practice?

   PLEASE DO NOT WRITE IN THIS TEST BOOKLET.

   Mark your answer in the circles in the grid.

   Do not mark on the graph above.

Here are some questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list: line of best fit, words per minute, weeks of practice, typing speed.

What words and/or symbols are unfamiliar and what do you think they mean?

Some of these words may be prediction, predict, typing speed.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question. What are you being asked to find?

Read the title of the graph and the labels on the sides. What facts does the graph tell you?

What information in the graph (the line, the points?) is relevant to what you need?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but be aware of the reasoning and operations that you are using. The following questions can be helpful.

In your own words, determine what to look for in the graph.

What value on the words-per-minute axis corresponds to 8 weeks of practice?

Find the answer and bubble in the correct answer on the standard grid.

Be ready to explain how you found your answer.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

***Small Groups:** Compare your answer to others in the group and explain why you think yours is correct.*

How did you know which information, the line or the points, was relevant?
Ask this question to reinforce the importance of careful reading in the math test.

Agree on the correct answer and the steps you would recommend to find it.
The likely procedure will include locating the 8, moving straight up to the line, and then following the horizontal line to the 80.

Using several answer grids, bubble in the correct answer in as many ways as you can.
Again, an overhead transparency of the graphic in the item as well as one of the standard answer grids would help the students refer to specific points and ways to answer when they are reporting to the whole class.

***Whole class:** Report your group's answer to this question, the steps that you recommend, and the various correct ways to bubble in the answer.*

Take notes on any different ways that others used to find or record the answer.

5. Reflecting, Extending and Evaluating

This stimulus is used for three questions on the test. It can be intimidating at first because students may have never heard of the statistical idea of a line of best fit. They will research the idea here and see how it works in this situation, but it is important to emphasize that they could have answered the questions without knowing the details.

Reflecting: Think about what you learned. (group activity or instructor lead.)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

You probably will not find an explanation of the line of best fit in many of the typical GED books. However, you may find one in some of the newer high school books that integrate mathematical topics from statistics with the traditional algebra and geometry. An explanation at an appropriate level can be found in *Mathematics in Action* (Consortium for Foundation Mathematics. p. 449.) This section also contains exercises that would serve as good practice for the concepts of slope and intercept that follow as well.

Read this problem and examine the graph again. Discuss your understanding of the steps involved in constructing the graph.

First, the data was collected from the 10 employees. The points were entered on the grid (weeks of practice, words per minute) resulting in a scatterplot of points. The points were not all on a straight line, but their position shows an overall trend (that is, as the weeks of practice (input) increased, so did the typing speed (output)). A line was estimated (the eyeball method is good enough for this discussion) and drawn to represent the trend that the data show. Finally, this line is used to predict what typing speed future employees might expect after a number of weeks of practice.

How would you write the point that corresponds to the answer for this problem in ordered pair format? (x,y)

The weeks of practice are along the horizontal axis (input) and words per minute are along the vertical (output) so the point would be (8,80).

Describe any way that you could use the calculator in answering this item.

Extending: Extend what you learned to new situations

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

These questions provide some review and practice in interpolating values on a graph.

What would your answer have been if the question had asked you to estimate the words per minute after 5 weeks of practice?

How many weeks does the line predict it would take to be typing at a rate of 40 words per minute? 60 words per minute?

Explain how this situation of typing speed and weeks practiced makes it reasonable to use this grid rather than the one in the previous activity.

Negative numbers are not reasonable for either typing speed or number of weeks

Evaluating : Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Remember your first reactions when you read this problem. Now that you have answered the question, what advice would you give to test-takers?

Don't panic. Read through the problem. You may find that the question is actually an easy one.

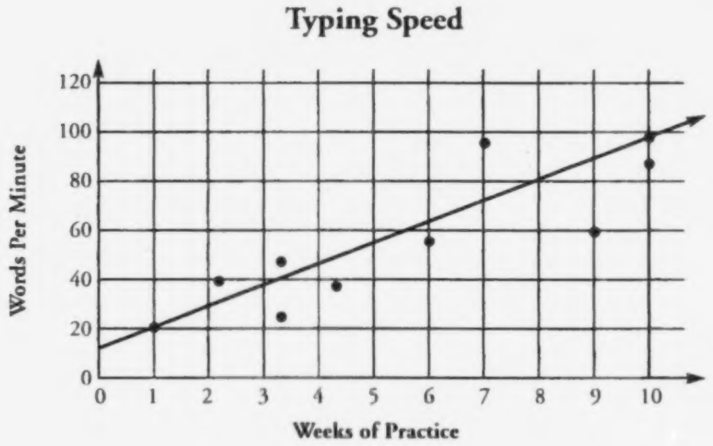
Learning Project 7 The Coordinate Plane, Intercepts and Slopes

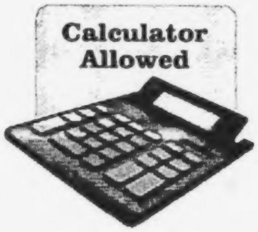
Inquiry Activity 7-3: A Line of Best Fit/Intercept

(Note: Italicized portions should be directed to students.)

1. Identifying the Problem (Item #5, PA) Calculator allowed.

Read the question carefully, as you would if taking the actual test.





Partners for Excellence offers its employees training classes to improve their typing skills. The graph above shows the typing speed results of 10 employees, as well as the line of best fit showing typing speed based on these results. The line of best fit can be used to make predictions for future employees who wish to take the classes.

5. Based on the line of best fit, what would be the approximate typing speed, in words per minute, of a person who had not practiced at all?

(1) 0
(2) 17
(3) 20
(4) 24
(5) 29

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list: line of best fit, approximate typing speed, words per minute.

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question. What are you being asked to find?

What information in the graph is relevant to what you need to solve the problem?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

In your own words, determine what to look for in the graph.

What value on the words-per-minute axis corresponds to 0 weeks of practice?

Estimate an answer.

Eliminate answer choices that are not reasonable.

Choose an answer. Be ready to explain how you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain why you think yours is correct.*

Agree on the correct answer and the steps you would recommend to find it.

One procedure would be to reason that since the number of weeks is 0, we can simply move up the vertical axis to the line of best fit. Estimate the value as between 10 and 20 and choose the only answer choice (#2 17) that fits.

Which words in the problem told you which point to locate?

What is the word you have learned for a point like this one?

In Inquiry Activities 1-2 and 3-1, they discussed the idea of a y-intercept. Use the overhead transparency of the graphic in the item to help the students refer to specific points when they are reporting to the whole class.

Whole class: *Report your group's answer to this question, the reasoning that made you choose that particular point, its mathematical name, and the steps that you recommend to approximate it.*

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. (A group activity or instructor led.)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

How would you write the point that corresponds to the answer for this problem in ordered pair format? (x,y)

This point would be (0,17).

Based on your original estimate, what number would you have bubbled in if this question had a bubble-in answer format?

This graphic is a little off here - many students may pick a number less than 17, maybe closer to 14 or 15. Assure them that in such a case, all reasonable answers would be considered correct. However, in the problem in multiple-choice format, there is only one possible correct answer.

Describe any way that you could use the calculator in answering this item.

Continue asking this question to convince them that the calculator is not important to every problem, even in the calculator section of the test.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe making new connections to other information.

What is the overall story that this graph is telling?

Because the line goes up as you move from left to right, it shows an increase as time passes: the longer that you practice typing, the faster you will be able to type.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

How does the understanding of concepts and words such as "line of best fit" help you to think through math word problems?

There are a lot of words in this problem. Is there a relationship between the amount of words in a problem and the difficulty of the math in the problem? Explain.

In the GED Practice Test Questions that you have been studying in these Inquiry Activities, do you see a math way of thinking or a thinking process that is used in math word problems? Explain.

How does an understanding of the math way of thinking help you to prepare for the GED?

How does a better understanding of the math way of thinking help to overcome math anxiety?

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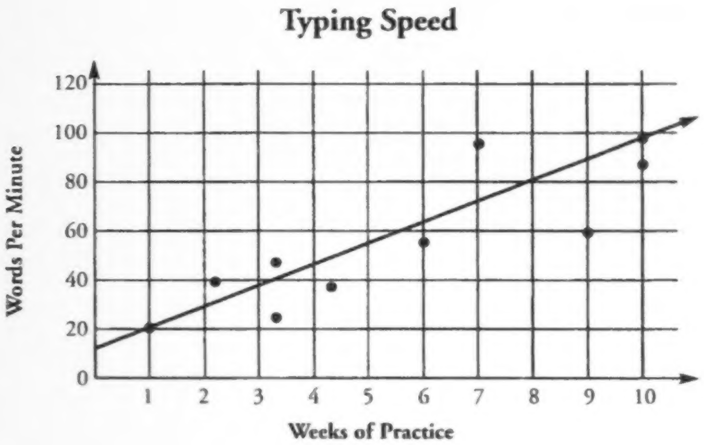
Learning Project The Coordinate Plane, Intercepts and Slopes

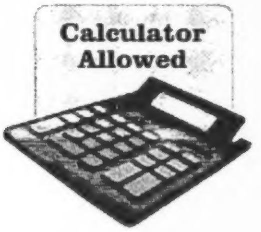
Inquiry Activity 7–4: A Line of Best Fit/Slope

(Note: Italicized portions should be directed to students.)

1. Identifying the Problem (Item #6, PA) Calculator allowed.

Read the question carefully, as you would if taking the actual test.





Partners for Excellence offers its employees training classes to improve their typing skills. The graph above shows the typing speed results of 10 employees, as well as the line of best fit showing typing speed based on these results. The line of best fit can be used to make predictions for future employees who wish to take the classes.

6. The slope of the line of best fit represents the increase in words per minute for each additional week of practice. Based on the slope of the line, by how many words per minute can an employee expect to increase her or his speed for each additional week of practice?

(1) 8
(2) 20
(3) 25
(4) 80
(5) 100

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

Cannot know what words the learner will choose. The following represents a possible, though non-exclusive, list: line of best fit, additional week of practice, words per minute, slope, increase.

What words and/or symbols are unfamiliar and what do you think they mean?

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question. What are you being asked to find?

What do you know about this?

What information in the graph is relevant to what you need to solve the problem?

3. Planning, Assigning and Performing Tasks.

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

In your own words, determine what to look for in the graph.

By how much does the line go up each week?

Estimate an answer.

Eliminate answer choices that are not reasonable.

Again, only the correct answer, 8, is reasonable

Choose an answer. Be ready to explain how you found it.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain why you think yours is correct.*

Agree on the correct answer, the steps you would recommend to find it, and the reasoning that supports it.

The critical underlying task is to translate the question into what it means on the graph – how much does the line go up each week? A close inspection shows that the line rises less than half a space each week. Since each space represents 20 wpm, 8 is the only answer choice that fits. Be prepared for students to take a variety of steps for a variety of reasons here. The formal definition of 'slope' will be discussed in the reflection step later.

Use the overhead transparency of the graphic in the item to help the students refer to specific points when they are reporting to the whole class.

Whole class: *Report your group's answer to this question, the steps that you recommend to find it, and the reasoning that supports them.*

Take notes on the different ways that others used to find the answer.

5. Reflecting, Extending and Evaluating

Reflecting: Think about what you learned. (A group activity or instructor led.)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

What general ideas were present in all the solution methods that the groups presented?

Most of them would have used a method that involved inspecting the graph and counting the number of squares. These visual, graphical concepts underlying the idea of slope are the most critical to emphasize at this level.

The slope of a line indicates the rate of change. Mathematically speaking, *t* is the ratio of vertical change to horizontal change or rise over run. Practically speaking, in this case, it refers to the increase in typing speed per week of practice.

It doesn't matter where they looked on the line to determine the slope; the change per week is the same each week, when you are dealing with a straight line.

Find some problems to practice finding the slope of a line from its graph.

The graph in this item is not ideal for this purpose because of the estimating required. Unfortunately, most traditional algebra textbooks immediately emphasize calculating the slope with the formula, without providing the graphical understanding first. There are some good exercises in Lesson 24 of the *Problem Solver* and on page 214 of *Smart Solutions: Comprehensive Math Review.*

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

The following questions about the slope formula are placed in the Extending section because the formula is not necessary to answer this question. However, by studying the formula, students will confront the mystery of subscripts and gain in their ability to understand what a complex formula instructs them to do.

Look on the formulas page of the Practice Test to find the mathematical formula that summarizes in mathematical language the process to use when finding the slope of a line. In your own words, explain what the formula tells you to do.

It says to find the difference between the y-values of two points and then divide (or compare in a ratio) that number by the difference between the x-values of the points. The subscripts are necessary so that the same order is maintained in both subtractions.

How is your method of finding the answer similar to the mathematical way?

Noticing how much change there was in the position of the line from week to week is the same as subtracting the y-values. The difference in the x-values is just 1, so no division had to be done.

In the previous activities, you have talked about two points on this line, (0,17) and (8,80). Use these two points and the formula to find the slope.

It doesn't matter which point is assigned as (x_1, y_1). $\frac{80-17}{8-0}$ U8, and $\frac{17-80}{0-8} = \frac{-63}{-8}$ U8.

Find some problems in your math books to use for practice finding the slope of a line using the formula.

These will be easier to find.

Next, you should refer back to a previous Learning Project and emphasize (again) that the slope of the line indicates the rate of change.

Connect what you have learned about slope of a line in this activity to what you learned before in Inquiry Activity 1-4.

Explain a major difference between the slope of a straight line and the slope of a curved line.

The slope of a straight line does not change while the slope of a curved line does.

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Compare your experience in learning to type (or learning some other skill) to the story told by the slope of the graph. Would you say that the rate of increase was the same in the early weeks as it was in the later weeks? Make a sketch of how your experience would be pictured or graphed.

Ask this question as a Just-in-Time assessment of whether students understood the idea that a steeper line will picture the greater rate of change.

Learning some tasks goes faster in the first stages and then slows down during the last stages. To picture this, start with a steep line (or curve) for the first weeks and follow it by a shallower line. Other tasks are very difficult at first, but once you catch on, progress is rapid. To picture this, a shallow slope for the first weeks will be followed by a steeper curve for the remaining time.

Noting that the slope of the line in the graph in this item is a positive number, what would you guess the slope of the curve in Activity 1-4 would be? Write a sentence that connects the two ideas of the sign of the slope and the overall story of the graph.

A positive slope tells a story of a value that increases while a negative slope tells a story of a decreasing value.

What story does a graph of a horizontal line tell?

A horizontal line tells a story of no change over time.

Finally, you may also want to connect the ideas of slope and rate of change with the equation of a straight line, $y = mx + b$ where m is the slope and b is the y-intercept. This connection is empowering for the student even though it may be a little academic for the GED test. For additional practice, look in algebra books for questions that involve a story rather than just naked numbers.

Connect what you have learned about slope of a line in this activity to the equation that was the answer for item #19 (IA3-1).

In the function, $T = 2x + 300$, how much does T (total cost) change when x (number of people attending) increases by 1? (As an example, you may want to use some easy numbers like 10 and 11 for x.)

The total cost increases by $2 with each additional person who attends.

Does this rate of change remain the same or does it change?

It remains the same.

Will the graph of this function be a straight line or a curve? What is its slope?

It will be a straight line with a slope of 2. Practically speaking, the slope in this case refers to the number of dollars per person.

Where do you see the slope (2) in the equation?

It is the number being multiplied by x.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

Write a few sentences that describe the progress toward your learning goals that you have made in this Learning Project.

Tell about how you think you can use the new knowledge and skills in your everyday life.

On which topics do you want more practice?

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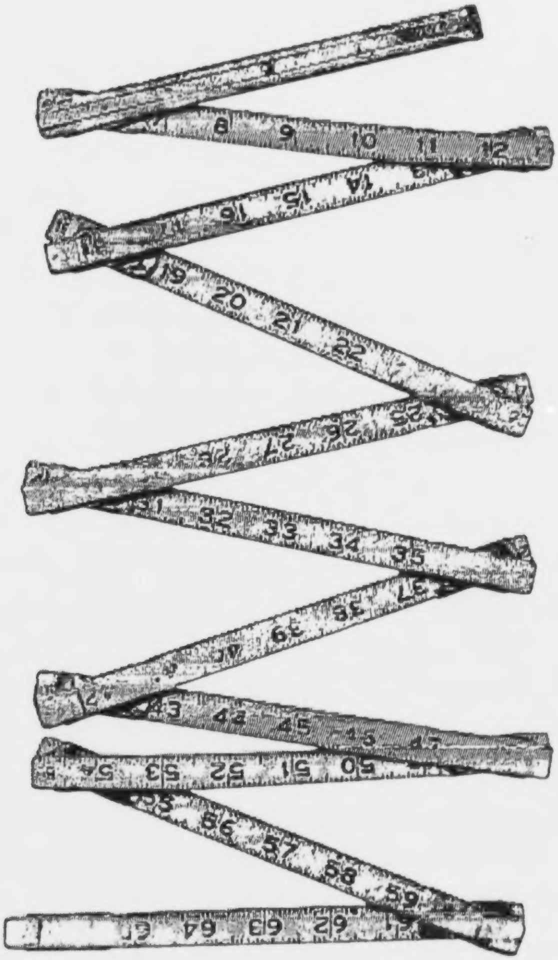
Learning Project

Geometry – Area, Perimeter, and Volume



Introduction

This is the first of two Learning Projects that deals with Geometry. An interesting aspect is that we have taken some of the shapes the learner has seen in other Inquiry Activities (as a stimulus for different math concepts) and asked geometry questions about the shapes. For instance, the two rectangles in the variation of question 25 that are used here in Inquiry Activity 8-2 first appeared as part of a proportion problem in Inquiry Activity 6-3. The circle on a grid that was used in the coordinate plane problem in Inquiry Activity 7-1 now appears in Inquiry Activity 8-4, where the learner is asked to determine how to estimate the area of a circle by counting squares and partial squares on the grid.

We hope that asking different questions about similar shapes stimulates the learner to recognize all the different questions one can ask about a shape. This is similar to the questions asked in the very first Learning Project when the learner was repeatedly asked to discuss all the information a graph reveals in addition to the question being specifically asked in the problem.

You will note that the Inquiry Activities move in a progression. Inquiry Activity 8-1 involves perimeters of rectangles. Inquiry Activity 8-2 deals with area of rectangles. Inquiry Activity 8-3 covers area of a triangle in a situation that gives the area and asks the learner to find the length of one of the legs of the triangle (a solution that will use the algebra learners explored in Learning Project 4 to solve for the unknown in the geometric formula). Inquiry Activity 8-4 deals with the circumference and area of a circle. Both the circumference and area are discussed in one question, which is not a normal format of GED type questions. You may want to produce another Inquiry Activity in which area is treated separately.

Volume is not emphasized only because the PA version of the Practice Test used here does not have any problems with volume, though Inquiry Activity 8-3 deals with volume in the Extending step. This does not mean volume problems are not on the GED itself. You can introduce the volume of squares and rectangles in the Extending phases of appropriate Inquiry Activities or develop your own that explore this math concept and formula. We encourage use of manipulatives and/or real life models in any and all appropriate geometry problems.

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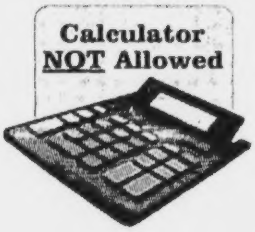
Inquiry Activity Geometry 8–1: Area vs. Perimeter of Rectangles

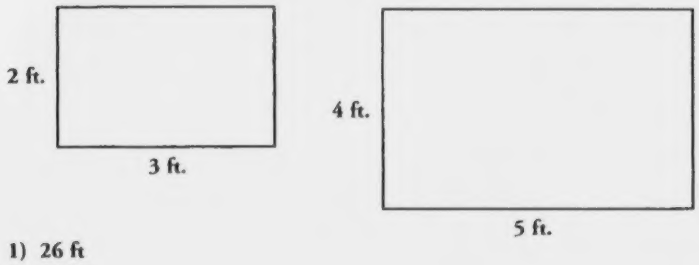
(Note: Italicized portions should be directed to students.)

1. Identifying the Problem (Item #25 variation, PA) Calculator not allowed

Read the question carefully, as you would if taking the actual test.

Lisa, a gardener, has two plots of ground to use for growing plants. She has two questions: How much edging will it take to go around the outside edges of both of these rectangular flowerbeds?





1) 26 ft
2) 26 ft^2
3) 28 ft
4) 28 ft^2
5) 52 ft^2

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

It is possible that learners would pick edging, rectangular, among others

What words and/or symbols are unfamiliar and what do you think they mean?

Cannot know what words the learner will choose.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful, so that you can remember to use them when you take the test.

Reread the question.

In your own words, what are you being asked to find?

Do you know of a math term that represents what you are being asked to find?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following can be helpful.

Make a sketch of what is to be found in this item.

Try using the formulas page.

Estimate an answer.

Eliminate some of the answer choices and explain why you eliminated them.

Choose an answer and be ready to explain how you found your answer.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain how you found it. Draw a sketch of what you have found. If you have trouble agreeing on one answer, be ready to explain the reasons behind your disagreement.*

There are many possibilities for disagreement. Some may want to multiply rather than add the sides. Some may insist that the answer should be in square feet. Everyone in the class can learn from the disagreements, so they should be brought to the whole-class discussion.

Explain any help you got from the formulas page.

Research the meaning of the unfamiliar words and/or symbols from this problem and the math word (if it was discussed in the group) that can be used to explain what the question is asking you to find.

Whole class: *Report your group's answer (or your disagreement over the answer) to this question, along with a sketch of what you have found, an explanation of how the formulas page can help, and the words and/or symbols and their definitions that were discussed in your group.*

Take notes on any different ways that others used to find the answer.

5. Reflecting, Extending and Evaluating

Make sure that everyone knows that they found the distance around the rectangles. The units used are units of length (one-dimensional) rather than the square units that they found in an earlier version of this problem. They should see that they could find the distance around the rectangles by merely adding the sides, without any reference to a formula. Finally, the formula should be discussed.

Errors caused by confusion between area and perimeter are common on tests. We hope that we can reduce these by explicitly examining the difference between them in their physical attributes, the type of units used by each and the applications of each. Display three measuring units during this discussion: a piece of string that is 1 foot long, a 1 square foot piece of newsprint (a small piece that is 1 square inch would also be helpful), and a cubic inch. (Any size cube will do, if you cannot find a cubic inch.)

Reflect: Think about what you learned. (group activity or instructor led)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

Use a piece of grid paper and draw two rectangles that look like the ones in the problem. One should be 2 units by 3 units, and the other should be 4 units by 5 units.

> I prefer using the centimeter square grid paper. Common quarter-inch grids are too small to be effective in this activity.

Start at one corner of a rectangle, go all the way around it, counting the spaces (units) that you pass as you go by. Do the same thing with the other rectangle.
How many units did you pass altogether?

The mathematical word for what you have found is "perimeter". Some teachers tell their students to notice the "rim" in perimeter. Explain why this could be helpful. Which of the measuring units on display would be used to measure the rim?

Find the formula for the perimeter of a rectangle on the formulas page. Compare what it tells you to do with what you have been doing. What are the similarities and differences between the methods? Which do you prefer and why?

Earlier, in Learning Project #6, you saw these same rectangles and were asked to find their area. Use the grid-paper rectangles again, but now count the number of squares in each rectangle.

> It really won't matter whether you do this before or after LP#6, since the concept of area of a rectangle is fairly commonly known.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

As you discussed above, when you find the perimeter of a figure, you are finding the length of something that would go all the way around it. Discuss situations in your lives that would require you to find perimeter.

Be prepared to use the information in this Inquiry Activity to help answer questions in Inquiry Activity 8-2.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

What progress did you make in achieving your personal math goals by participating in this activity?

Of all the things that you learned in this activity, what do you consider to be the most important for you to remember while taking the test?

Which things do you think will be the most important to you in your life?

Ask for practice exercises, if you think you need them.

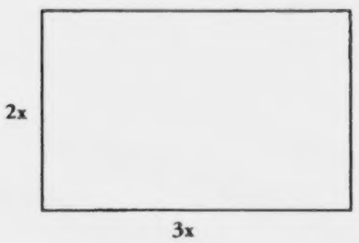
Inquiry Activity Geometry 8–2: Area of Rectangles

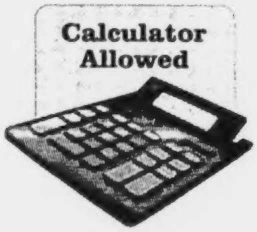
(Note: Italicized portions should be directed to students.)

1. Identifying the Problem (Item #11, PA) Calculator allowed.

Read the question carefully, as you would if taking the actual test.

11. The dimensions of the rectangle shown below are 2x by 3x.





How many square units are in this area?

1) 12
2) 5x
3) 10x
4) $5x^2$
5) $6x^2$

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

It is possible that learners would pick dimensions, rectangle, square units, area among others.

What words and/or symbols are unfamiliar and what do you think they mean?

Cannot know what words the learner will choose.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question.

In your own words, what are you being asked to find?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following can be helpful.

Make a sketch that will help you to determine what is to be found in this item.

Try using the formulas page.

Estimate an answer.

Eliminate some of the answer choices and explain why you eliminated them.

Choose an answer and be ready to explain how you found your answer.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain how you found it. Compare sketches that were used to help find an answer, and determine which sketch helps the best. If you have trouble agreeing on one answer, be ready to explain the reasons behind your disagreement.*

There are many possibilities for disagreement. Some may want to add rather than multiply the sides. Some may not know what to do with x's. Everyone in the class can learn from the disagreements, so they should be brought to the whole-class discussion.

Explain any help you got from the formulas page.

Research the meaning of the unfamiliar words from this problem and the math terms square units and area.

Whole class: *Report your group's answer (or your disagreement over the answer) to this question, along with a sketch that best helps you come to an answer, an explanation of how the formulas page can help, and the words and/or symbols and their definitions that were discussed in your group.*

Take notes on any different ways that others used to find the answer.

4. Reflecting, Extending and Evaluating

This Inquiry Activity continues to explore ways to avoid errors caused by confusion between area and perimeter that are common on tests. The formula for area should be discussed, together with how to express x in terms of a square unit. We continue to explicitly examine the difference between perimeter and area in their physical attributes, the type of units used by each and the applications of each. Display three measuring units during this discussion: a piece of string that is 1 foot long, a 1 square foot piece of newsprint (a small piece that is 1 sq inch would also be helpful), and a cubic inch. (Any size cube will do if you cannot find a cubic inch)

Reflect: Think about what you learned. (group activity or instructor led)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

Use a piece of grid paper and draw a rectangle that looks like the one in the problem. How do you show the x?

I prefer using the centimeter square grid paper. Common quarter-inch grids are too small to be effective in this activity. The x would just be attached to the number for each dimension as it appears in the problem.

Now count the number of squares in the rectangle. What will you do with the x when expressing the area of this rectangle? Research in the texts (or the work you did in previous Learning Projects) how x gets represented in the answer.

Find the formula for the area of a rectangle on the formulas page. Would you get the same answer using the formula as you did when you counted squares?

Let us say that x=3. Draw a rectangle that represents the dimensions of this rectangle. Now count the number of squares. What has happened to the x in the answer?

Find the formula for the area of a rectangle on the formulas page. Would you get the same answer using the formula as you did when you counted squares?

Extending: Extend what you learned to new situations.

These questions use the information from the last Inquiry Activity to compare that information to the new material discussed here. Although you could extend the activity by using yardsticks to measure the room exactly, you will challenge the students more (and have more fun!) by asking them to estimate the lengths. They will likely pace off the length and width (You can compare one person's pace-length to another's), and use a person standing against the wall to estimate the height. In this way, yards and feet will be intermixed and need to be made uniform. Since there are no items on this practice test that involve volume, this activity should be extended to include the volume of a rectangular solid such as the room.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe making new connections to other information.

When you find the area of a figure, you are finding how much surface is inside. Your answer tells how many square units are there. Discuss situations in your lives that would require you to find area

Estimate the measurements of the room that you are in.
What is its approximate length, width, and height?
What is the approximate area of the floor?
What is the approximate area of the largest wall?
What is the approximate area of the ceiling?
What is the approximate volume of the room?

A good estimation process. You might want to make connections to the estimation process often used in step 3 of the math template.

How is the formula for volume a natural progression from the formula for area?

Multiplying two dimensions for area and multiplying 3 dimensions for volume.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

What progress did you make in achieving your personal math goals by participating in this activity?

Of all the things that you learned in this activity, what do you consider to be the most important for you to remember while taking the test?

Evaluate the formulas page as a test-taking tool.

Which things do you think will be the most important to you in your life?

Ask for practice exercises, if you think you need them.

Learning Project Geometry – Area, Perimeter, & Volume

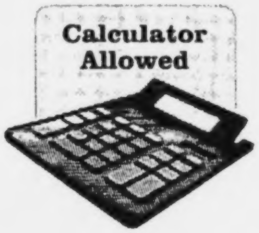
Inquiry Activity Geometry 8–3: Triangles

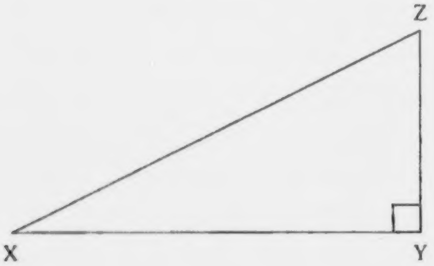
(Note: Italicized portions should be directed to students.)

1. Identifying the Problem (Item #8, PA) Calculator allowed.

Read the question carefully, as you would if taking the actual test.

8. Leg XY of the right triangle shown in the diagram is twice as long as the leg YZ.





If the area of the triangle is 36 cm^2, what is the length, in cm, of leg XY?

1) 6
2) 9
3) 12
4) 18
5) 24

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

It is possible that learners would pick leg, right triangle, diagram, twice as long, area, cm^2, length, leg XY, among others.

What words and/or symbols are unfamiliar and what do you think they mean?

Cannot know what words the learner will choose.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question.

In your own words, what are you being asked to find?

Think about the knowledge you have of triangles and right triangles.

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

Make a sketch that will help you to determine what is to be found in this item.

The sketch could be the diagram with the lengths of given lengths incorporated. Also learners can draw a rectangle on graph paper draw a line that would divide the box into two triangles, showing that a right triangle is 1/2 of a rectangle. If no one comes up with this at this point, can use it in the Reflect or Extend portions of step 5.

Try using the formulas page.

Estimate an answer.

Eliminate some of the answer choices and explain why you eliminated them.

Might eliminate answer with 6 since there is not an easy number that when multiplied, equals 6. In other words, the square root of 6 is not an easy number to determine.

Choose an answer and be ready to explain how you found your answer.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

Small Groups: *Compare your answer to others in the group and explain how you found it. Compare sketches that were used to help find an answer, if any, and determine which sketch helps the best. If you have trouble agreeing on one answer, be ready to explain the reasons behind your disagreement.*

There are many possibilities for disagreement. Everyone in the class can learn from the disagreements so they should be brought to the whole-class discussion.

Explain any help you got from the formulas page.

Research the meaning of the unfamiliar words and/or symbols from this problem and the math terms "square units" and "area."

Whole class: *Report your group's answer (or your disagreement over the answer) to this question, along with a sketch, if any, that best helps you come to an answer, an explanation of how the formulas page can help, and the words and/or symbols and their definitions that were discussed in your group.*

Take notes on any different ways that others used to find the answer.

5. Reflecting, Extending and Evaluating

This Inquiry Activity continues the discussion of area started in the last Inquiry Activity. Here the discussion moves from the area of rectangles to the area of right triangles. The formula for area of triangles should be discussed in its relation to rectangles. Many area problems have the learner find the area. Here the area is a given and the learner has to manipulate the formula for the area of a triangle to come up with the answer. The lessons learned in algebra about working through an equation are very prevalent here. This is a rich problem.

Reflect: Think about what you learned. (group activity or instructor led.)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

Review all the different ways that were presented to find the answer to this problem and determine the most efficient method to solve the problem.

Suppose the length of ZY is 5, XY is twice that size and you have to find the area using graph paper only. Would you be able to count the squares to find the area of the triangle? Explain.

What else could you do using graph paper to find out exactly the area of this triangle?

> Can draw a rectangle with the sides given, count the total number of boxes in the angle, then realizing that the triangle is 1/2 the rectangle, divide the total by two.

Find the formula for the area of a triangle on the formulas page.

What is the relationship between the formula and the use of graph paper to solve this problem?

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

How do you set up and use the formula for triangles when you have one side is an unknown (ZY) and the other side (XY) is twice the size?

How can you use algebra to set up this equation?

Discuss situations in your lives that would require you to use triangles.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

In step 5, Reflecting, Extending, Evaluating, we ask you to start you thinking about the experience you just had. We then go on to say:

> *Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.*

Would you agree that thinking about what you did in solving a problem is part of the learning process? Explain.

Ask for practice exercises in any of the areas covered in this Inquiry Activity if you think you need them.

Learning Project Geometry – Area, Perimeter, & Volume

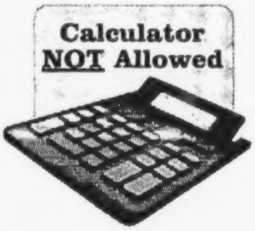
Inquiry Activity Geometry 8–4: Circles

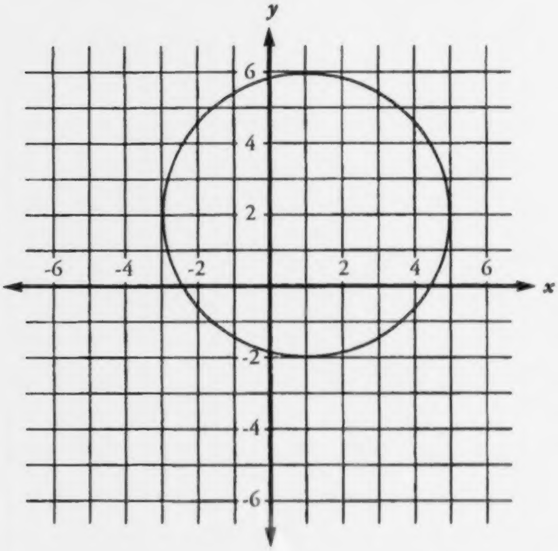
(Note: Italicized portions should be directed to students.)

1. **Identifying the Problem (Uses a variation of Item #22, PA) Calculator not allowed.**

Read the question carefully, as you would if taking the actual test.

The graph of a circle is shown on the grid below.





One side of each square on the graph equals 1 inch.

What is the circumference and area of the circle shown?

1) C = 20.12" and A = 50.25 square inches
2) C = 25.12" and A = 50.25 square inches
3) C = 20.12" and A = 40.25 square inches
4) C = 25.12" and A = 40.25 square inches
5) C = 40.25" and A = 20.12 square inches

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?

It is possible that learners would pick circumference, area of circle among others.

What words and/or symbols are unfamiliar and what do you think they mean?

Cannot know what words the learner will choose.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question.

In your own words, what are you being asked to find?

Think about the knowledge you have of circles.

3. Planning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but be aware of the reasoning and operations that you are using. The following questions can be helpful.

Try using the formulas page.

Estimate an answer.

Eliminate some of the answer choices and explain why you eliminated them.

Choose an answer and be ready to explain how you found your answer.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. Take this opportunity not only to share your knowledge, but also to learn it more completely.

Small Groups: Compare your answer to others in the group and explain how you found it. If you have trouble agreeing on one answer, be ready to explain the reasons behind your disagreement.

Determine the various methods used to estimate an answer.

Explain any help you got from the formulas page.

Research the meaning of the unfamiliar words and/or symbols from this problem and the math terms circumference.

Whole class: Report your group's answer (or your disagreement over the answer) to this question, along with your estimation process, if any, that best helps you come to an answer, an explanation of how the formulas page can help, and the words and/or symbols and their definitions that were discussed in your group.

Take notes on any different ways that others used to find the answer.

5. Reflecting, Extending and Evaluating.

This Inquiry Activity culminates the discussion of perimeter and area in the context of a circle.

Reflect: Think about what you learned. **(group activity or instructor led.)**

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned.

Review all the different ways that were presented to find the answer to this problem and determine the most efficient method to solve the problem.

Can the fact that the circle is presented on graph paper help you in estimating area?

Would be able to count the full squares to find the area of the circle while estimating the partial squares to come up with an estimation.

Does the circle on graph paper help with estimating circumference?

Find the formula for the circumference of a circle on the formulas page. Discuss how to use the formula to solve the problem.

Find the formula for the area of a circle on the formulas page. Discuss how to use the formula to solve the problem.

Both the formula for circumference and area of a circle involve pi = 3.14. Research in the text books what pi is and how and why it is used in these formulas.

Extending: Extend what you learned to new situations.

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe make new connections to other information.

Discuss situations in your lives that would require you to use circles and the circumference of circles.
Tires on cars or bikes or equipment to fit rims.

Evaluating: Assess what you learned and how you learned it.

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

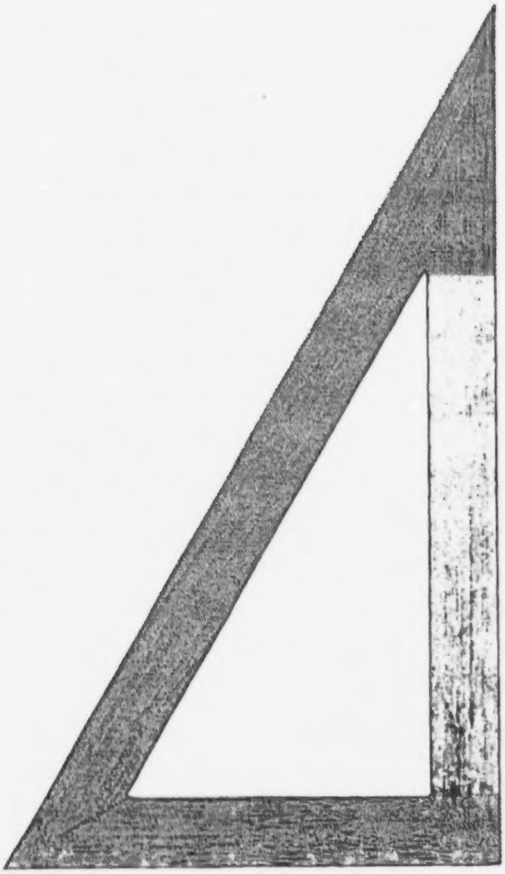
In step 5, Reflecting, Extending, Evaluating, how does the extending section help you to learn the subject?

Does extending your knowledge also help with test-taking? Explain

Ask for practice exercises in any of the areas covered in this Inquiry Activity if you think you need them.

Learning Project

Geometry – Angles and Triangles



Introduction

There is only one Inquiry Activity in this Learning Project. It explores the angles that make up an isosceles triangle without using that term. Interestingly enough, the formula page is of no help here, so learners should really become aware of what information they have to bring to the test, and what help they can get from the GED Formula page.

This Inquiry Activity allows learners to cut and measure triangles to get a specific understanding of the number of degrees in a triangle and the make-up of an isosceles triangle.

The Evaluation question here focuses on the Extending stage of the template process. It is an important activity.

The Pythagorean Theorem was not covered in these Learning Projects because this version of the practice test did not have a problem with the concept. However, you will note that the formula appears on the Formula page of the GED which means questions on the subject will most likely appear on some version of the test itself. You can devise an Inquiry Activity that covers the subject, or you might ask the learners to study the topic and, either individually or in groups, and come up with test questions that others in the class should answer. A very active learning exercise!

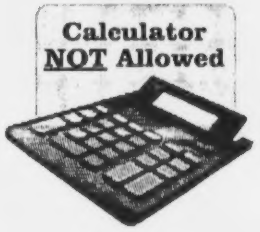
Learning Project Geometry – Angles & Triangles

Inquiry Activity Geometry 9–1: Triangles

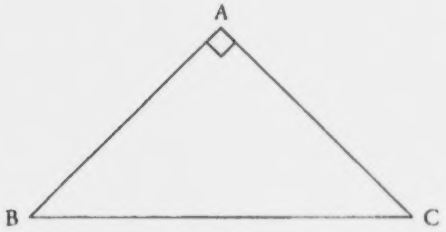
(Note: Italicized portions should be directed to students.)

1. Identifying the Problem (Item #17, PA) Calculator Not allowed.

Read the question carefully, as you would if taking the actual test.



17. For the right triangle shown in the diagram below, angle A measures 90° and sides AB and AC have the same length. What is the measure of angle C?



1) 30°
2) 45°
3) 60°
4) 90°
5) 135°

Here are some problem clarification questions you may want to consider when reading test questions.

What words and/or symbols might be important to understand to answer this problem and what are they telling you?
It is possible that learners would pick right triangle, diagram, angle, measures, same length, among others.

What words and/or symbols are unfamiliar and what do you think they mean?
Cannot know what words the learner will choose.

2. Becoming Familiar with the Problem

Ask yourself questions like these about the problem, taking note of the ones that were especially helpful so that you can remember to use them when you take the test.

Reread the question.

In your own words, what are you being asked to find?

Think about the knowledge you have of triangles and right triangles. How can you use that knowledge to help solve the problem?

3. Planning, Assigning and Performing Tasks

Try to answer the test question any way you can, even if you have to guess, but try to be aware of the reasoning and operations that you are using. The following questions can be helpful.

What might you guess the answer to this problem would be? Be prepared to explain the steps you used to guess at an answer.

Without any hints, learners will likely guess correctly on this one because many remember that the angles of a triangle add to 180°, and angle B looks equal to angle C in the diagram.

Estimate an answer

Try using the formulas page.

Eliminate some of the answer choices and explain why you eliminated them.

Might eliminate answers number 4 and 5 since both these answers would produce a triangle of more that 180°, since there is still one more angle, angle B, to consider.

Choose an answer and be ready to explain how you found your answer.

4. Sharing with Others

Telling other people what you know helps you to understand the material better. So take this opportunity not only to share your knowledge, but also to learn it more completely.

***Small Groups:** Compare your answer to others in the group and explain how you found it. If you have trouble agreeing on one answer, be ready to explain the reasons behind your disagreement. Discuss test-taking strategies, including guessing.*

Explain any help you got from the formulas page.

Research how angles are measured, what a right triangle is, and the sum of angles in a triangle.

***Whole class:** Report your group's answers, an explanation of how the formulas page can help, the research on how angles are measured, the definition of a right triangle, the right angle symbol and the sum of angles in a triangle.*

Take notes on any different ways that others used to find the answer.

5. Reflecting, Extending and Evaluating

Reflect: Think about what you learned. (A group activity or instructor lead.)

Here are some questions to start you thinking about the experience you just had. Thinking about what you have learned and experienced is part of the learning process. When the focus is only on the answer, you don't get much time to think about what was learned)

Review all the different ways that were presented to find the answer to this problem and determine the most efficient method to solve the problem.

How do you intend to use the formula page provided on the GED in studying for the GED?

How do you intend to use the formula page provided on the GED while taking the GED?

Your instructor will provide paper for this exploration. Take the paper and fold it, and cut various triangles. Then use a protractor to measure the base angles.

The fold is the altitude of the triangle and will make the two sides equal. Learners will see specifically that the base angles of an isosceles triangle are equal.

Extending: Extend what you learned to new situations

In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe making new connections to other information.

Discuss situations in your lives in which you might use your knowledge of a triangle with equal sides and a 90° angle might be useful.

Discuss situations in your lives in which you might use the knowledge that all the angles of a triangle equal 180°.

Evaluating: Assess what you learned and how you learned it

In this last step, you get a chance to review the content of what you learned and the methods used to learn. There are no right or wrong answers to these questions; it is your chance to look more closely at your learning style and the opportunity to state how you benefited or didn't benefit from the content and/or the methods to help you pass the GED test.

In the Extending portion of Step 5, we ask you to extend the problem you just explored.

> *In extending, you are being asked to transfer the information presented in the Practice Test question to other information or situations you already know and maybe making new connections to other information.*

How helpful do you think this step is in preparing to take the GED? Explain.

How helpful do you think this step is in becoming more confident in math?

How helpful do you think this step is in overcoming math anxiety?

Ask for practice exercises in any of the areas covered in this Inquiry Activity if you think you need them.

Appendix 1

What Math/Test-taking Skills Can You Access?

Practice Test PA Items	Accessible Math Content	Learning Skill	Test-taking Skill
1. Kelly's goal is to average $25,000 per month in sales for the first three months of the year. Her sales for January and February are shown in the graph below. To reach her goal, what is the minimum amount of sales Kelly must make in March?	- Informational graphs (Use variation) Operation sense (+,-) - Data Analysis (mean)	Careful reading of labels on graphs.	Standard answer grid (with variation)
2. Ms. Nguyen is a real estate agent. One of her clients is considering buying a house in the Silver Lakes area, where 6 houses have recently sold for the following amounts: $160,000; $150,000: $185,000; $180, 000; $145,000; $190,000. What should Ms. Nguyen report as the **MEDIAN** price of these houses?	- Data Analysis (median)	Compare definitions to arrive at meaning. Draw sketch.	Use formulas page.
3. If 3x - 6 = 12, what is the value of x? Mark your answer in the circles in the grid on your answer sheet.	- Algebra/Equations	- Check answer using truth of statement. - Visualize concepts.	- Standard answer grid
4. What does the line of best fit predict the typing speed, in words per minute, will be for an employee who attends eight weeks of practice? Mark your answer in the circles in the grid.	- Graphing/ coordinate - Data Analysis	Focus on relevant information	- Standard answer grid - Don't panic at an unfamiliar concept.
5. Based on the line of best fit, what would be the approximate typing speed, in words per minute, of a person who had not practiced at all?	- Graphing/Coordinate - y-intercept - interpolation	Derive meaning of unfamiliar words by the context surrounding them.	Use possible answer choices

Appendix 1 *(continued)*

Practice Test PA Items	Accessible Math Content	Learning Skill	Test-taking Skill
6. The slope of the line of best fit represents the increase in words per minute for each additional week of practice. Based on the slope of the line, by how many words per minute can an employee expect to increase her or his speed for each additional week of practice?	- Graphing/Coordinate - Slope of line - Rates/constant change - Algebra (subscripts)	Construct a web of connecting ideas.	Use the formulas page.
7. Electric switches that regularly sell for \$0.69 each are advertised this week at 5 for \$2.75. How much is saved by purchasing 5 switches at the sale price rather than at the regular price?	- Rates - Operation sense (x,-)	Use contextual experience to help solve problems.	- Estimation - Check answer.
8. Leg XY of the right triangle shown in the diagram below is twice as long as leg YZ. If the area of the triangle is $36\ \text{cm}^2$, what is the length, in cm, of leg XY?	- Geometry/Area - Square root - Algebra		- Use the formulas page - Use possible answer choices.
9. The standard formula used by mechanics to find the length (L) of a fan belt of a car is as follows $L = 2C + \frac{11(D+d)}{7} + \frac{(D-d)^2}{4C}$ where D and d are the diameters of the wheels around which the belt runs, and C is the distance between the centers of the wheels. What is L (in inches) if $D = 12$ inches, $d = 2$ inches, and $C = 25$ inches?	- Algebra - exponents - order of operations	Calculator can sometimes be a hindrance. Break problem into parts.	Don't panic.

Appendix 1 *(continued)*

Practice Test PA Items	Accessible Math Content	Learning Skill	Test-taking Skill
10. Juanita had her care windshield replaced at a cost of $250. After a $50 deductible is applied (i.e., Juanita pays the first $50,) her insurance company will pay 80 percent of the remaining balance. In dollars, how much will the company pay?	- Fractions, Proportions, Percents	– Can use own invented methods to solve.	- Standard answer grid.
11. The dimensions of the rectangle shown below are 2x and 3x. How many square units are in its area?	- Algebra - Geometry/Area		Use formulas page
12. Susan left $650 in a savings account for one year. At the end of that time she received an interest credit of 5%. Then she withdrew all of her money and had to pay a service charge of $1.75. How much money did she have after paying the service charge?	- Fractions, Proportions, Percents	Break multi-step problems down into simpler steps.	
13. The mean (average) weight of 5 boys is 160 pounds. If three of the boys weigh 152, 158, and 168 pounds respectively, which of the following could be the weights, in pounds, of the other two boys?	- Data Analysis (mean) - Algebra	Break multi-step problem down into simpler parts.	Use formulas page
14. The scale on a hiker's map states that 1 inch = 2000 feet. Anna wants to know how far it is to her next campsite. On the map, the next campsite is 5 inches from her present location. What is the actual distance, in feet, between Anna's present location and her next campsite?	- Rates - Proportions	Use contextual experience.	

Appendix 1 *(continued)*

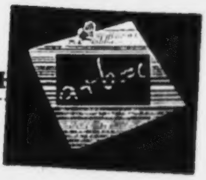
Practice Test PA Items	Accessible Math Content	Learning Skill	Test-taking Skill
15. The graph below shows the expected rainfall from a hurricane, based on the speed at which the hurricane is moving. Based on the graph, what would be the approximate amount of rainfall, in inches, if a hurricane moves at 12 mph?	- Graphs (Informational) - Interpolating with both scales. - Change not constant.	Careful reading of labels on graphs	- Estimation - Use answer choices.
16. A company charges \$60 per day plus \$0.50 per mile for truck rentals. If Greg rents a truck for 3 days and drives it a total of 150 miles, what will the company charge?	- Rates - Operation sense (x,+)	- Use context experience. - Break multi-step problem down into simpler steps.	- Estimate
17. For the right triangle shown in the diagram below, angle A measures 90° and sides AB and AC have the same length. What is the measure of angle C?	- Geometry/Triangles - Angle sum - Measure of angles - Isosceles		Guess when necessary.
18. A carpenter is making a larger triangular brace similar to the one shown below. The base of the new brace is 36 inches. What is the length, in inches, of side b, if the triangles are similar? Mark your answer in the grid.	- Proportions-similar figures - Geometry/ Pythagorean theorem (use variation)	- Make sense of formula with sketches or examples.	- Use formulas page.
19. To rent a ball field for a game costs a \$300 basic fee plus a \$2 fee per person. If *x* persons attend the game, which equation can be used to find *T*, the total cost of renting the ball field?	- Algebra/ variables - Mathematize - rates	Substitute easy numbers for the variable.	- Set-up item

Appendix 1 *(continued)*

Practice Test PA Items	Accessible Math Content	Learning Skill	Test-taking Skill
20. When none of the games has been sold, the revenue from sales will be zero. At the same time, the cost of production is expected to be approximately $150,000. Why might this be true?	- Graphs/Informational - y-intercept - story of graph	Focus on relevant information.	Extraneous information
21. Based on market surveys, the cost of production is eventually projected to be greater than the revenue from sales. The graph shows that this is likely to occur after approximately how many games have been produced?	- Graphs/Informational - points of intersection - Approximate value - story of graph - change illustrated	Focus on relevant information.	- Estimate - Extraneous information
22. The graph of a circle is shown on the grid below. What point is the location of the center of the circle? Mark your answer on the coordinate plane grid.	- Graphs/Coordinate - Circle characteristics - Points on coordinate plane - Negative numbers on a number line - Subtracting to find difference between signed numbers.		- Coordinate plane grid
23. Julio invested a sum of money at 6% interest. Krista invested $200 less than Julio, but her bank paid her 9% interest. After one year, what was the DIFFERENCE between the amount of interest Krista had earned and the amount of interest Julio had earned?	- Percent - Interest formula	Be careful when guessing.	Not enough information

Appendix 1 *(continued)*

Practice Test PA Items	Accessible Math Content	Learning Skill	Test-taking Skill
24. Carpenters earn an average of \$1120 less per month than designers at a furniture factory in Smithville. The factory employs 3 designers and 15 carpenters. Let x represent the average monthly pay of a designer. Which of the following functions correctly shows the relationship between the monthly payroll (P) and the wages of these employees? - Algebra/variables	- Mathematize - Operation sense (+,x) - Rates	Use easy numbers in place of variables.	Set-up item
25. The public transportation system in Central City charges \$90 for a 2-ft. by 3-ft. rectangular advertising space in its buses. If the price (x) of an ad is proportional to its **AREA**, which of the following expressions correctly determines the price (x) for a 4-ft. by 5-ft. advertisement?	- Proportions - Mathematize - Equivalent representations - Geometry/area	Be flexible to accommodate other correct methods of solution.	Set-up item



Appendix 2

Mathematics Learning Projects – GED Practice Test PA

1. Graphing (Informational) and Reading Scales (Number Line):

#1(a variation), #20, #21, #15

- On a rectangular graph, the bars, lines, or points show a connection between the vertical and horizontal scales.
- Read exact values of points and approximate values that are between grid lines. Talk about rounding.
- Discuss significance of certain points – the intercept and intersections of lines
- Discuss the concept of change as it is pictured in a graph.
- Ongoing extension: bring in samples of all kinds of graphs.

2. Rates:

# 7, #16

- Rely on the students' experiences to help them to find the answer.
- Reflect on the use of multiplication in these rate problems.
- Write mathematical expressions that describe the process that they used to find the answer.
- Discuss how the calculator can be helpful sometimes and be extraneous for some other facets of problem solving.

3. Algebra/Using a variable to mathematize a situation:

#19, #24, #11

- The set-up items build on the expressions that were written for the rate problems.
- Introduce the idea of a variable as a way to generalize arithmetic.
- Introduce the use of an exponent.

4. Algebra/Equations:

#19 variation, #3, #9

- Use the variation of #19 to show that they already understand equation solving when it is part of a real context.
- Show how the algebraic rules make sense in a practical way.
- Emphasize that the solution is the number that makes the equation true.

5. Data Analysis – Mean and Median

#2, #1 (also in informational graphs), #13

- Approach the problems informally, but when reflecting, try to make sense of the algebraic notation used in the definitions.
- Alert them to the formulas page.

Missing Concept: Probability

- This practice test does not include any items involving probability. You may want to go back to #28 in the old Practice Test CC to discuss the idea and introduce the use of fractions.

6. Fractions, Proportions and Percents:

Missing Concept: Size of Fractions:

- Although it is not likely that the GED test will emphasize performing operations with fractions, it is important that students are confident about and can work flexibly with the relative size of fractions and their equivalent representations as decimals and percents. Since these ideas are not present in any of the items in this particular practice test, incorporate them into the following items whenever possible or go back to item #8 in Practice Test CC.

#14, #18, #25, #10, #12, #23

- Encourage students to use their own reasoning to find the answers to these items, looking for the solid mathematics that is present. Later in the reflection phase, compare the student methods to the formal textbook procedure, allowing that there are many ways to solve problems. Students should strive to be flexible, using the method that makes sense to them and fits the problem.
- Emphasize the connections to previous activities – rates, algebra, fractions.

7. Graphing/coordinate:

#22, #4, #5, #6

- Use #22 to become familiar with the coordinate plane as well as the characteristics of a circle. In addition, it can also serve as the stimulus to talk about the number line with negatives and finding the distance between signed numbers. This is the only item in this practice test that mentions negatives, so use the extending phase to introduce them.
- Use #4, 5, and 6 to illustrate how a real situation changing over time can be pictured. Connect the idea of the y-intercept to earlier item #20.
- Discuss slope as the rate of change and try to make sense of the definition. Introduce the generalized linear function, $y = mx + b$, by using examples from previous items (#19). Compare to #15 where slope was not constant.

Insert the following projects anywhere after the algebra projects:

Geometry/Area, Perimeter and Volume:

#25, #11, #8, #22

- Most of these items are also in other Learning Projects. Use #11 and #25 to clarify the idea that square units are used to measure area. Superimpose grids so that squares can be counted before the formulas are used.
- Item #8 provides a rich problem that should bring out many individual reasoning methods. It also allows connections to be made to the rectangle items, the algebra procedures, and finding a square root. As before, do not force the formula, use it in the reflecting phase to sum up what has been discussed.
- #22 (the circle on the coordinate grid) is a perfect stimulus for this project as well. Begin by counting the squares inside the circle (some estimating with fractions will need to be done as well.) Introduce the idea of *pi* along with the formula and compare results. Use the same process with the circumference of the circle. Be sure that students are aware that the formulas page will be included in every test.

Missing Concept - Volume

- Introduce the idea of volume in the extending phase. Manipulatives and real-life models are helpful.

Geometry/ Angles, Triangles, etc

#17

- Without any hints, students will likely guess correctly on this one because many remember that the angles of a triangle add to 180°, and B looks equal to C in the diagram. That makes this item a good example of the likely probability that there will be items on the test that stump them. Discuss test-taking strategies, including guessing.
- In the sharing phase, let students research and explain how angles are measured, what a right angle is, and even show that the angle sum of every triangle is 180°.
- While reflecting, engage the students in an exploration where they cut various triangles from folded paper (the fold is the altitude, thus making two sides equal) and then use a protractor to measure the base angles. Soon they will discover that the base angles of an isosceles triangle are equal.

Missing Concept – Pythagorean Theorem

Variation of #18 and #17

- Use the right triangles that are pictured in these two items to discuss the Pythagorean Theorem. To visualize what the theorem is saying, begin by asking the students to draw a square grid on each side of the small triangle in #18.
- Write a variation of the item, showing only the larger triangle with the two sides of 36 and 39 labeled. Ask the students to use the theorem to find the length of side A. (Calculator allowed)
- For #17, make up a variation where the length of BC is 10 inches. Use the theorem and a calculator to find the length of the other two sides.

Appendix 3

Sample Individual Action Plans

LEARNER'S NAME DATE

CLASS INSTRUCTOR

What is your reason for wanting the GED?

1. How would you rank your test-taking skills for the GED test?

(low) 1 2 3 4 5 (high) Date: ______

Comments:

(low) 1 2 3 4 5 (high) Date: ______

Comments:

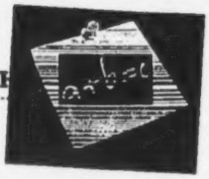
2. How would you rank your reading skills in the context of the GED?

(low) 1 2 3 4 5 (high) Date: ______

Comments:

(low) 1 2 3 4 5 (high) Date: ______

Comments:



Appendix 3

Sample Individual Action Plans *(continued)*

LEARNER'S NAME DATE

CLASS INSTRUCTOR

Develop a GED & You action plan for yourself that covers the following:

a) Based on how I ranked myself for reading (on page 1 on this form), what I will do to improve my reading for the GED, if necessary.

b) How I plan to improve my test-taking skills for the GED.

c) How often I will attend class and study for the GED. (Include here any problems you may have attending class or studying and how you plan to deal with the problems.)

My Action Plan Date: ____________

LEARNER'S SIGNATURE INSTRUCTOR'S SIGNATURE

Appendix 3

Sample Individual Action Plans *(continued)*

LEARNER'S NAME DATE

CLASS INSTRUCTOR

My MATH Action Plan. *(A similar form will be presented for the other GED subjects).* Go to page 1 and rank yourself at this time (include the date) on your reading and test-taking skills. Then read over the following questions and respond to them in your Math Action Plan.

a) What math subjects am I most familiar with?
b) What do I want to know about math?
c) How can I use my reading skills to help with math word problems?
d) How can I use my thinking skills to help with math word problems?
e) How can I use test-taking skills in the math portion of the GED?
f) What parts of my "GED & You" Action Plan can I use in this Math Action Plan?

My MATH Action Plan Date: ______________________

LEARNER'S SIGNATURE INSTRUCTOR'S SIGNATURE

Appendix 3

Sample Individual Action Plans *(continued)*

LEARNER'S NAME ______________________ DATE ______________________

CLASS ______________________ INSTRUCTOR ______________________

(This Action Plan revisited is to be used in the middle of a content area. You will already have given the GED & You Action Plan and a content Action Plan, like math, but you have not finished the content area.)

My Action Plan Revisited.

a) Review my GED & You Action Plan and the Content Action Plan.

b) What more have I learned about reading for the GED since my last Action Plan and what I will do to improve my reading still further if necessary?

c) How has my GED & You Action Plan worked with regard to studying for the GED? What changes do I want to make?

d) How has my original plan to attend class and study for the GED worked? Include here what changes I want to make to this part of my plan and why.

My Action Plan, Revisited Date:______________________

LEARNER'S SIGNATURE ______________________ INSTRUCTOR'S SIGNATURE ______________________

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EFF-089 (1/2003)